suppose that the birds wandered to us from there. I have never heard of the Gold-crest occurring in China; but this will be sufficient authority to enable us to enrol it on our list. The species is very close to the European *Regulus cristatus*; but Bonaparte separates it as *R. japonicus*. It has purer white on the lores and round the eye, and the hind neck is strongly tinged with grey.

On the 20th October we landed at Shanghai, and so finished our cruise to Peking and our glimpse at the Northern fauna.

9. On the Saiga Antelope, *Saiga tartarica* (Pall.). By James Murie, M.D., F.L.S., F.G.S., &c., late Prosector to the Society.

In the twelfth fasciculus of the 'Spicilegia Zoologica' of P. S. Pallas (published at Berlin in 1777—that is, nearly a hundred years ago) will be found not only an erudite historical and descriptive account of the *Antilope saiga*, considered in its external bearings, but also a very accurate *résumé* of all the anatomical structures of value as regards classification. The author likewise has figured the skull, stomach, and gall-bladder.

Pallas's observations, to my mind, contain the kernel of all that is useful for zoological purposes*. As, however, there still remain points that seem worthy of investigation, I proceed forthwith to tender, as a communication, notes upon two specimens which have come under my inspection.

I may crave indulgence, under these circumstances, as, if some of the data I bring forward are not entirely new, they are doubtless not generally known. A benefit towards science may result from recognizing the correctness of Pallas's statements; whilst a fresh investigation, entering more into detail in some structures, at least admits of a reconsideration of the animal's affinities.

For the latter reason, and because a fuller description of this recent but ancient-like type of mammal may serve as a basis of future comparison to palæontologists as well as zoologists, I have written a lengthy account of the skeleton, which the naturalist above referred to briefly sketches rather than describes. The skull, in particular, offers several points of departure from the Antilopidæ, among which the Saiga is classed; and thus the taxonomic bearings of such aberrance is a factor of some importance.

I. The Skeleton.

1. *Spine and adventitious Bones.*

(A) *Vertebræ.*—The spinal column consists of 7 cervical, 13 dorsal, 6 lumbar, 4 united sacral, and 12 caudal elements, in all equal

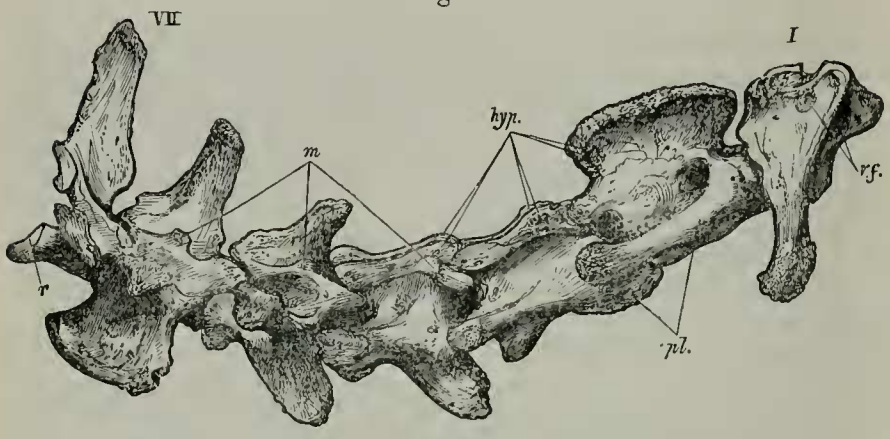
* Glitsch, I may mention, recently has usefully supplemented Pallas in a paper on the *Saiga*, chiefly devoted to its geographical distribution (*vide* Bull. Soc. Hist. Nat. Moscou, 1865, pp. 207–245).

to 42 vertebræ, the last, however, being a mere diminutive ossicle. Pallas* states that there are 5 lumbar vertebræ, without mentioning how many are in the tail.

In a very complete and excellently mounted skeleton†, in the College of Surgeons' Museum, of an adult Saiga, wild, or procured in its native haunts, I find that there but 11 caudal vertebræ, the final 2, as above, being ossified bodies of very minute size. The other vertebral regions agree with what has been mentioned as existing in the Society's animal.

The cervical vertebræ (fig. 1), possess characters by which individually they can readily be distinguished the one from the other. Their long diameters are unequal, as are those of the spinous and other processes.

Fig. 1.



The cervical vertebræ, about one-third their natural dimensions.

I., VII. First and seventh vertebræ. *v.f.* Vertebral foramen of atlas. *pl.* Rudimentary pleurapophyses of axis and third vertebra. *hyp.* Hyperapophyses or bifid spine-tubercles of second, third, and fourth cervicals. *m.* Fourth, fifth, and sixth metapophysial elements. *r.* First rib-facet.

But to proceed *seriatim* with the Society's male specimen, the atlas is remarkable on account of the great lengthening of the tranverse processes. These are somewhat flattened from above downwards, directed obliquely outwards and backwards, terminating in a roughened slightly bulbous manner. From tip to tip they measure $3\frac{3}{4}$ inches. The spinous process is well nigh obsolete, with deepish muscular depressions in front; the laminæ posteriorly have a low broad arch. The anterior shallow articulating surface presnts to the eye a crown-shaped outline, the lower and somewhat obliquely backwardly descending articulating surface of the concavity being mesially divided by a sharp ridge, so that the facets move on the post-basioccipital processes when the head is bent downwards. The

* *Op. cit.* p. 45.

† This male skeleton (No. 3729 A, interleaved Catalogue) is stated to have been obtained in South Russia, and purchased of Herr Möschler, 2nd October, 1867.

vertebral foramina pierce the sides of the body almost vertically, close behind the root of the cranial articulating processes. The postarticular surface of the body is tolerably level and semilunar. A short knobby sessile projection represents the ventral keel (hypapophysis); it is situated far back.

As regards the antero-posterior diameters of the bodies of the cervicals, the following numbers express a sufficiently near approximation to their relative sizes in inches and decimals:—1st, 1·2; 2nd, 2·3; 3rd, 1·6; 4th, 1·6; 5th, 1·5; 6th, 1·3; 7th, 1·0.

By such it is seen that the axis is the longest of the neck-vertebræ, as, indeed, obtains in many of the Ruminantia, although in the long-necked Giraffe and Camelidæ, where the whole of the cervicals are subequally long, it is not so obvious. Its neural spine is also by far the strongest, an inch high, and two antero-posteriorly; thick and stout, with an expanded, roughened, free border, cleft behind (hyperapophyses of Mivart*), but single and produced in front, where it overlies the posterior incised portion of the laminar arch of the atlas. The wide foramen for the vertebral artery enters the spinal canal at the anterior end and upper lateral surface of the body. The odontoid process is short, gouge-shaped, and surrounded by a wide, flattened, semilunar articular surface. The transverse processes are of considerable size, though nevertheless small, as compared with the great wing-like processes of the atlas. Moreover they disagree with these latter in being concave below and more convex above, and in their derivative angle from the body being more acutely backwards. There is only a rudiment of a pleurapophysis at the root of the diapophysis. A deepish ventral spine exists for nearly the whole length of the body. Posteriorly it is bulbous, but in front of this thin, sharp, and laterally compressed.

The third and fourth vertebræ present characters very much akin to each other. They agree in the great reduction of the spine, deeply bifid in both, smallest in the third, but in each only occupying the anterior half of the neural arch—in the great lateral expansion, flattening, or even forward concavity of the neural laminæ—in the broadening and more outstanding position of the transverse processes—in possessing large diapophyses—in the production of the keel being slightly less than in the axis, and more concavely marginate.

The distinctive differences are:—in the fourth having the highest spine; but the third, while less high, has the neural laminæ produced forwards as a low process, which fits into the triangular interspace between the posterior articulating (or zygapophysial) facets of the axis; in the laminar arch of the third being slightly broader and less concavely marginal; in there being only an obscure metapophysis in the third, whereas it is fairly developed in the fourth; in the transverse process and diapophysis of the third running antero-posteriorly almost in the same plane, whilst in the fourth they are at a distinctly obtuse angle to each other.

The alteration of the configuration of the fifth cervical consists in

* "Axial Skeleton in the Primates," P. Z. S. 1865, p. 576.

shortening of the body and transverse processes—in the latter being more bulbous terminally, and slightly upturned—in lengthening of the spine, which is uncleft— in a gradual increase of laminar arching—in separative distinctness of a metapophysial projection—in an alteration of the position of the transverse process to the pleurapophysis, so that they begin to be superior and inferior to each other instead of antero-posterior—in diminution of the ventral keel, which, however, is more inflated posteriorly.

At the sixth cervical, the inclination of the neck towards the shoulders is apparent. This vertebra altogether is shortened lengthwise and across; but the elongation of the spinous and pleurapophysial elements vastly increases the total depth. The changes observed in the fifth are here continued and augmented: for example, the neural spine is almost twice as long in the sixth; the inferior mesial ridge of the body is reduced to a hardly perceptible linear elevation; the transverse process and pleurapophysis have undergone such relations that the latter is absolutely posterior, its inclination is in that direction, and its breadth twice as great as in the preceding vertebra.

The seventh vertebra, as usual, puts on characters which assimilate it to the dorsal series. The most notable of these is the great elongation and backward direction of the spinous process; next, the total absence of pleurapophysis and foramina for the vertebral arteries; and lastly, the presence of a small costal facet.

Transition to dorsal vertebræ, though manifest in the last cervical, is yet somewhat abrupt, the first dorsal being altogether larger, with proportionally an enormously developed spine Moreover its body, as commencing the dorsal region ventrally, is set at an obtuse angle to those of the neck, the plane of the former being directed upwards and backwards, the latter upwards and forwards.

The pattern of the bodies of the dorsal vertebræ is twofold; but they run into each other; viz. as far as the 5th or 6th they are broadish and convex inferiorly, thence to the lumbar region laterally compressed and slightly carinate.

The laminæ throughout correspond to the length and strength of the spinous process. Where this is long and stout, the laminar arch is more acute, and, inversely, lower and arciform as the neurapophysis shortens.

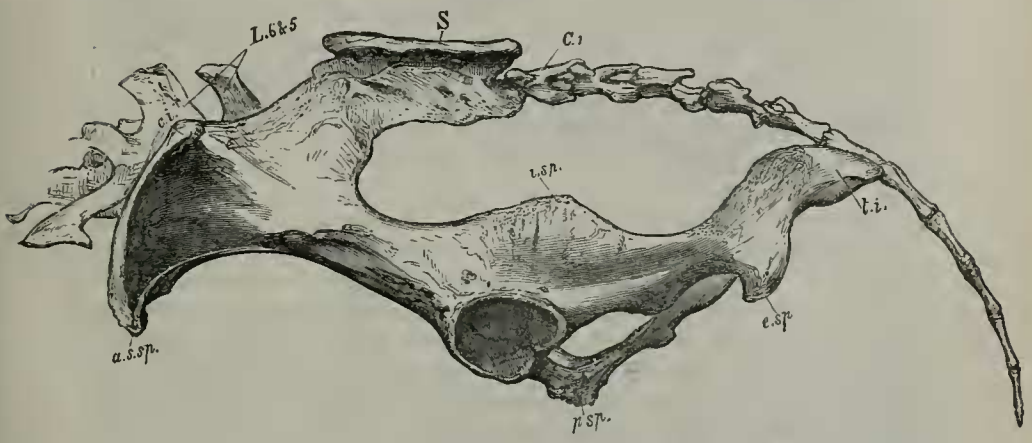
The spine of the first dorsal is very slightly shorter, and tapers more than the 2nd and 3rd, and equals the 4th in length, which latter has a truncate tip. These four spines slant well backwards. At the 8th or 9th vertebra an alteration is apparent, and, from the long spatular shape directed posteriorly, the spines become short, more erect, with an anterior terminal elongation, and at the last dorsal the change to the lumbar type is complete.

That which appertains as a marked feature of the lumbar vertebræ is the length of the transverse processes; at least, this is especially so in the penultimate and two preceding ones. They are thin, relatively narrow, excepting the first, and each terminates in a hastate manner. The first and last are shorter than the intervening

four. The hindermost pair of processes are the most delicate of all. Metapophysial prominences of moderate elevation rise up from the root of each transverse process, and they barely pass forwards beyond the zygapophysial articulation. The spines, nearly uniform in height, decrease in breadth from the 1st to the 7th, the last being less than half the breadth of the first.

Though the neurapophyses are pretty vertical, they appear to slant forwards from their anterior extremities being elongated as a blunt spine. The body of the hindermost lumbar vertebra is the stoutest and shortest, those in front subequal in long diameter.

Fig. 2.



Side view of sacrum, caudal vertebræ, and pelvis of male *Saiga* : $\frac{3}{7}$ nat. size.
L. 6 & 5. The sixth and fifth lumbar vertebræ, the pointers being directed to their spines. *S.* Sacrum. *C.* 1. First caudal vertebra. *a. s. sp.* Anterior superior spine of the ilium. *c. i.* Crest of the ilium. *i. sp.* Ischial spine. *t. i.* Tuber ischii. *e. sp.* External spinous process of ischium. *p. sp.* Pubic spine.

The four coalesced sacral vertebræ together present the crucial figure which usually obtains in Ruminants. The first of the four vertebral elements, or that which yields the main abutment to the ilia, is a trifle over $\frac{3}{4}$ of an inch lengthwise in body; but transversely the diameter from the margin of one sacro-iliac synchrondrosis to the other is three inches. The pelvic surface is very level and smooth, and the auricular portion or augmented transverse process of moderate dimensions. The second, originally separate, element of the sacrum, here only distinguishable by the presence of the foramina, appears to have a limited share as a buttress against the ilium, just anterior to the bay of the great sciatic notch. It, along with the third and fourth segments of ossification, compose the narrow distal or handle end of the cross-shaped sacrum. The transverse processes and metapophyses are cemented together, so as to represent a doubly shelving mass on either side of the bodies. The four neural spines constitute but one consolidated mass, a couple of inches long, and dorsally thickened.

The caudal vertebræ may conveniently be regarded as consisting of two kinds:—those exhibiting enlarged or moderate-sized, and those with very diminished or obsolete processes. Of each there are five or six, according to where the line of demarcation is fixed; for the gradation of change is the opposite of abrupt. The three proximal to the sacrum distinguish themselves by the length of the neural spine, which runs backwards as a narrow, depressed, triangular bar, almost touching the root of the spine posterior to it. The third is rather shorter. The neurapophyses are well developed in each. In the first the transverse process is broad, assimilating to the hinder end of the sacrum. In the succeeding two the transverse processes are smaller and slant outwards and backwards from the distal segments of the body. The fourth, fifth, and sixth vertebræ have altogether much shorter processes, dorsal and lateral. The remaining caudal bodies are more or less expanded at each extremity. The tail as a whole is feeble, and terminally slender.

(B) *Costal Arches and Sternum.*—Of the thirteen vertebral* ribs the anterior eight have sternal attachments, the remainder come under the heading of floating or free ribs. The front five are more or less vertically placed, the sixth and those posterior by degrees take a wider sweep backwards. To the eighth, counting from before backwards, they progressively increase in length; thence they diminish in quicker ratio to the thirteenth. The last and the third ribs are subequal in length, the first and the second the shortest. The first costal arch, including its presternal keystone, when examined in front or from the interior of the thorax, is short and narrow; the remainder of the costal cavity by degrees enlarges, and is absolutely wide at the last ribs.

The first rib, stoutish and with little of a curve, is $4\frac{1}{2}$ inches in its chord of diameter. It is flat, as are all the ribs within, but it is the most convex externally. Its angle and capitulum are thick; and the sternal end (*vide* fig. 3) is also much elongated.

These characters are considerably reduced in the 2nd and 3rd. The 4th, 5th, 6th, and 7th are remarkably thin, and broaden out distally. The 8th and ribs posterior are much narrower. The angles in all the ribs are badly defined.

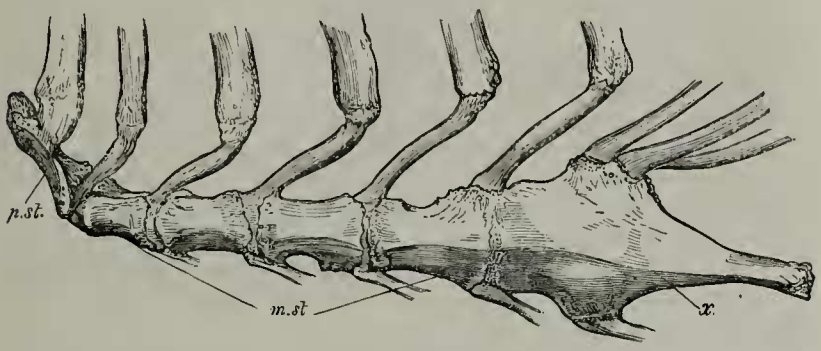
The first sternal rib (Parker), or costal cartilage, abuts against the uppermost præsternum, and is very short. The succeeding four sternal ribs are each about 1 inch long; the 6th, 7th, and 8th lengthen and strengthen considerably, the rest of the free cartilages (sternal ribs) are wider, but long and styliform.

Seven osseous segments can be traced in the adult sternum (fig. 3); the last three, however, are adnate and interossified, those in advance have a meagre cartilaginous separation. The præsternum (*p.st.*), thick and narrow, is set at an obtuse angle upwards to the other sternal elements. Viewed ventrally, the 1st mesosternal piece (*m.st.*) has a cup-shaped outline, the narrow end forwards; the

* In using the term "vertebral," in contradistinction to "sternal" rib, I follow the precise morphological nomenclature of my friend Mr. K. Parker, in his valuable monograph 'Shoulder-girdle and Sternum' (1868).

others behind are subquadrate, increasing consecutively in length and width, the last being double the width of the first. The xiphosternum (*x*) flat, and obliquely downwardly bent, has a broad proximal base, which narrows suddenly and, becoming spatular, terminates with a slightly expanded tip.

Fig. 3.



Three-quarters underview of sternum, with cartilages and portion of the ribs attached. *p. st.* Præsternum. *m. st.* Mesosternum. *x.* Xiphosternum.

2. *Of the Cranial Framework.*

(A) *Different Aspects of the Skull.*—In several particulars the skull of *Saiga tartarica* is isolated or unique amongst living Ruminants, though, as will be shown hereafter, one or more ancient types foreshadowed the peculiarities. Pallas (*l. c.* tab. iii. figs. 9 & 10) has given reduced figures of it in profile, and in front foreshortened; and Dr. Gray, in his 'Catalogue of Mammalia in the British Museum,' 1852 (tab. vi. figs. 1 & 2), has likewise represented similar views. In those figures, however, the horns and general outline of the skull seemingly have been more attended to than definition of the coadapted osseous areas; hence fresh representations are, in a great measure, a necessary adjunct to a description of the bony elements of this *bizarre* Ruminant's skull. The skull of the hornless female and the horned male necessarily exhibit different aspects*.

Dealing with the latter, when looked at sideways (shown in fig. 5), the prominent features may be summarized as follows:—

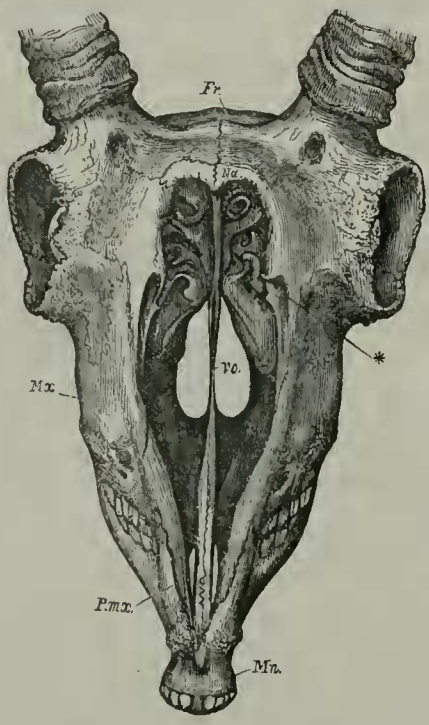
* Skeletons of the *Saiga* hitherto have been rare in this country. Besides the Hunterian and the present specimen, I only know of one other, which was obtained some years since by the Museum of the University of Cambridge—where in addition are two skulls (male and female), all being from wild animals. Professor Newton obliged me by kindly transmitting the two latter crania for my inspection. Comparing these with that here described and the College of Surgeons' specimen, I detected little differences worthy of special record other than sexual, *i. e.* diminution of osseous sutural ridges and absence of horns in the female. I may also add that the tympanic bullæ in the female were relatively more inflated than in the male; in the latter laterally compressed and very ovine.

1st, the extraordinary shortness of the nasal region, the face, as it were, being scooped out, leaving only an exceedingly narrow extension forwards of the maxillary and premaxillary bones; 2nd, the great vertical depth of the naso-maxillary region; 3rd, the relatively prominent, large, and staring orbit; 4th, the very small, shallow zygomatic arch; 5th, the moderate-sized, roundish, occipito-temporal region; 6th, the long, erect, tapering horns.

In bird's-eye view, or from above, the skull is elongate, somewhat diamond-shaped, the palato-maxillary being considerably longer than the parieto-occipital segments. The orbits form two salient projections, behind and above which the horns start forth.

Examined in front, or facially foreshortened (as in fig. 4), the horns appear to slant well backwards, the frontal bone being rather depressed. The broad orbital rings stand well out. The short nasals are raised, below which the turbinal bones are exposed; and beneath these, between the inner borders of the maxillaries, is an immense narial vacuity. The irregular-surfaced, long, narrow palato-maxillary shelf forms the floor of the forwardly jutting nares.

Fig. 4.



Foreshortened facial view of skull and mandible of the Society's adult male *Saiga*.
Fr. Frontal. *Na.* Nasal. *Mx.* Maxillary. *Pmx.* Præmaxilla. *Mn.* Mandible. *Vo* Vomer. * Points to pit of lachrymal duct.

From behind, the cranium presents superiorly a broad flattened

arch, the orbital plates forming the outer boundary. The horns issue vertically above the small temporal fossæ. The occipital region is relatively narrow and ovoid; the semilunar condyles are no way prominent, and laterally bound a squarish foramen magnum. The compressed and, in this view, thin, paramastoid processes are but moderately long and perpendicularly set.

The base of the skull (see fig. 6) is characterized—1st, by great orbital breadth; 2nd, by the molar arch enclosing a rounded pterygo-malar space, posteriorly limited by a wide glenoid articulating surface; 3rd, the basioccipital region is broad relatively to its length; 4th, the tympanic bullæ of medium size; 5th, the posterior nares very deep and moderately wide; 6th, dental portion of palate broad, but much narrower in front, slightly concave from behind forwards and across; 7th, the masseteric portions of the maxillaries bulge considerably beyond the alveoli; 8th, the premolar teeth incline inwards, a ridge running on to the premaxillaries; 9th, the premaxillaries are produced forwards, in a flattened beak-like manner.

I may further add, as a feature of some moment, that when the skull rests basally on a horizontal surface (the top of a table for example), the crown and nasals strike upwards, nearly parallel, at about an angle of 20° to the plane. This, so far as I am aware, is not the case with any other living Bovine form; indeed, instead of the parietals and nasal tops exhibiting parallelism of plane, they trend downwards at a more or less obtuse angle from each other. *Alces* and *Rupicapra* offer no exception, though the horns of the latter are well nigh erect.

(B) *Individual Bones.*—The parietals (*Pa.*) are short and low-arched. The coronal suture is strongly marked by two semilunar ridges, whose concavities are forwards; and they blend together in a line with the sagittal suture, and run on in a slight ridge towards the prefrontal region.

Between the horns, and partly to their rear, the frontal bone (*Fr.*) is moderately elevated, with shallow lateral depressions. In advance of their roots, however, the bone shelves rapidly to a lower horizontal level, continuous with the nasals. The osseous horn-core springs obliquely backwards, above and slightly behind the orbit. A large triangular supraorbital foramen is situate at their base, and half an inch beyond the outer raised border of the bone terminates in a small eminence joining the lachrymal. The broad fronto-orbital plate juts well outwards, producing the greatest cranial breadth at this part, as it forms the upper and posterior circuit of the orbit. An irregular bordered wedge-shaped portion of the frontal is inserted betwixt the nasal and lachrymal bones, which, however, falls short of, and is much higher than, the maxillary bone.

The diminishment of the nasals and correlated extensive intermaxillary space, or open narial region, are the most extraordinary features of the skull. The stoutish ossa nasi (*Na.*), 1-inch long, together constitute an almost equal-sided triangle, instead of an elongate splint of bone surmounting the nasal arch, as in general

obtains in the Ruminant skull; including the short-nasaled Elk. As already intimated, they are set in a plane horizontal to the anterior portion of the frontals, though, from the descending sweep which the maxillaries take, the nasals appear to have a more upward cast than they in reality possess. Their upper surface is smooth and convex, the fronto-nasal suture being nearly transverse. The anterior free borders are rough for the attachment of the nasal cartilages; and on each outer corner is a small subquadrangular wing-piece, 0·3 inch in diameter, which inferiorly is suturally connected with the lachrymal. No portion whatsoever of the maxillary or premaxillary bones is in conjunction with the nasals; in this respect, therefore, they differ materially from those of most Ruminants. Even *Alces americana*, distinguished by shortened nasals and præmaxillæ, does not agree with *Saiga*, as its maxillæ and nasal bones are partially coadapted, although the præmaxillæ are widely apart from the latter.

Examined from in front, the ethmoid and turbinate bones are large and sinuous, the inferior turbinate, especially, being tilted at an acute angle upwards and forwards. A small portion of their anterior ends projects beyond the interior border of the lachrymal; and to this inferior turbinate portion the upper lateral nasal cartilage is partially adherent. In spite of the very diminished length of the nasals, it is to be observed that their tips reach a point perpendicular to the infraorbital foramina or anterior true molar, the latter, as to a certain extent is the case in the true goats, being as it were, thrust backwards relatively to the facial region.

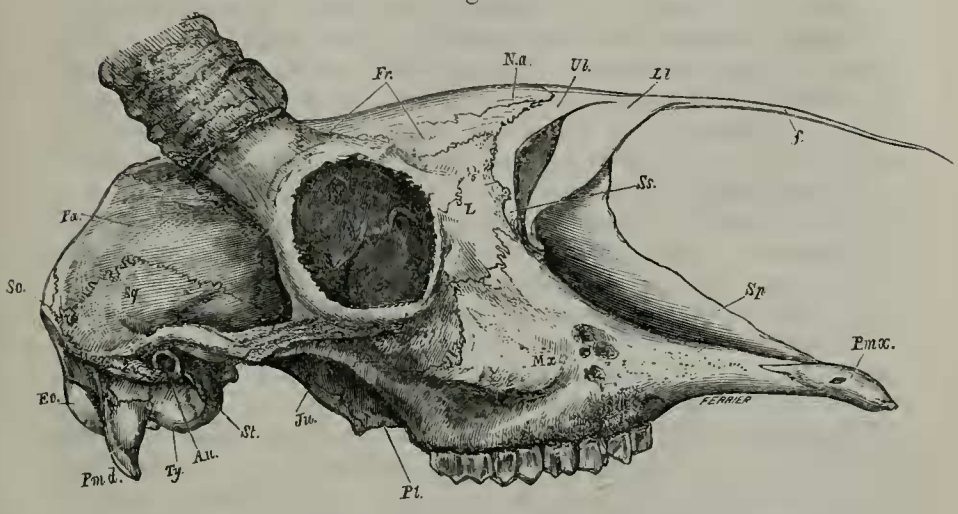
The development of the lachrymal bone is peculiar and noteworthy. In some senses, by its great vertical depth, does it give that strange aspect in profile to *Saiga* which elevates, as it were, the nasal region of the animal; while at the same time, by its more than ordinary enlargement, the lachrymal entirely excludes the maxillaries from reaching the nasals, as obtains in all the other artiodactyla. In shape, the lachrymal (*L*) is irregularly contoured, though it exhibits a tendency to a quadrate figure, divided, however, by a portion of the raised thin orbital ring.

The cheek-surface is more or less impressed by three concavities, the chief of which is the ante- or suborbital fossa. This is obovate, shallowish, but broad, and lies at the inferior border of the bone; above it is a small osseous tubercle. The fossa contains the so-called crumen or suborbital gland. About a sixth share of the ring and inner orbital plate is constituted by the lachrymal. The foramen for the lachrymal duct pierces the bone within and just beneath the anteorbital angle. The superior border of the lachrymal joins the frontal, and barely touches the middle outer border of the os nasi. Below, the lachrymal intrudes into the maxillary, as in Antelopes and Sheep, agreeing with the former, however, in the angular abutment of the piece. To the narial side of the ascending process of the maxillary an inlaid splint of the lachrymal descends; and the root of this is pierced by a large foramen (* fig. 4), wherein the lachrymal sac is lodged. This opening, in the fresh condition of the parts, is overlain by the sesamoid nasal cartilage (*Ss*, fig. 5); whilst the

edge of the inferior point of the lower lateral cartilage rests in the groove in front of the foramen.

The malar or jugal bone (*Ju*) occupies between a fourth and a third of the orbital ring; forms a broad buttress, which rests on the antrum of the maxillary, and sends back a short narrow spur to join the zygomatic process of the temporal.

Fig. 5.



Skull of male *Saiga* in profile, with nasal cartilages *in situ*.

Na. Nasal. *Fr.* Frontal. *L.* Lachrymal. *Mx.* Maxilla. *Pmx.* Præmaxilla. *Pa.* Parietal. *So.* Supraoccipital. *Eo.* Exoccipital. *Sq.* Squamosal. *Pmd.* Paramastoid. *Ty.* Tympanic. *Au.* Auditory bulla. *St.* Styloid. *Pt.* Pterygo-palatine. *Ju.* Jugal. *Ul.* Upper lateral cartilage. *Ll.* Lower lateral cartilage. *f.* Fibrous cord of nares. *Ss.* Sesamoid. *Sp.* Septal cartilage, its fibrous portion being partially removed.

The premaxillaries (*Pmx.*), like the nasals, are conspicuous by their small size or abortive development. Each is no more than $1\frac{3}{4}$ inch in extreme length, and, unlike that of any other Ruminant, merely tips the maxillary, without the palatal portion reaching the vomer. Both limbs of each >-shaped premaxillary are much flattened from above downwards, the upper stouter one possessing only a very limited tendency to override the projecting process of the maxilla.

The somewhat scalene-figured cheek-surface of the maxillary bone (*Mx*) has a pronounced masseteric ridge, which runs well up towards the orbit. In front of its anterior and lower end, perpendicular to the last premolar, are four large sieve-like foramina; and through these the thick infraorbital nerves reach the facial region. I have already spoken of the long nasal or ascending process of the maxillary which dovetails between the divergent lachrymal pieces; but the opposite or rostral portion of the maxilla is equally interesting. This latter anterior segment, which forms the anterior palatine roof or premaxillial floor, and in a less degree contributes to the outer

prenarial wall, is remarkable on account of its outwardly long cylindrical character. In these respects, and in the absolute shearing out of the upper or nasal border of the maxilla, this bone in the Saiga is distinguishable from that of every living Ruminant. The antrum of Highmore, or sinus maxillaris, is very capacious, and the osseous walls altogether thin. A portion of it projects more than usual into the pterygo-maxillary and zygomatic fossa; and this gives, when seen from the palate, a rounder figure to the fossa than obtains in ovine, caprine, or cervine forms. In the Chiru, *Panthalops hodgsoni*, an analogous inflation and extension of the postmaxilla is observable; and it is further curious to note that both the Saiga and the Chiru are distinguished among antelopes on account of their nasal appendages. Regarding these and the enlarged larynx of Pallas's *A. gutturosa*, Turner remarks (P. Z. S. 1850, p. 168)—"These seem to be physiological adaptations, in no case marking a group, and therefore insufficient to warrant generic distinction, which has been made in the two latter instances." So far I agree with that meritorious author; but had he seen the skulls, he would have found other distinctions whereon to base separation.

The palatal plate of the palate bone (*Pl.*), pierced by the posterior palatine foramen, is relatively large for a bovine. Behind it is broad and widely arching over the rounded front border of the posterior nares, gives much greater breath to this part than is found in the Antilopidæ or even Ovidæ; with its neighbouring plate of the opposite side, they, together crescentiform, reach forwards mesially to opposite the middle of the posterior lobe of the penultimate molars. As far as this latter disposition is concerned, it evinces leanings towards Sheep and Goats rather than Antelopes; moreover in Deer and Cattle these horizontal palatal plates in general pass to opposite a molar beyond the above. The very thin, moderately broad, yet remarkably deep, vertical pterygo-palatine plate of the Saiga, as in other ruminants, mainly forms the inner wall of the sphenomaxillary fossa, being strengthened moreover by the somewhat united stouter pterygoid process of the sphenoid bone.

The opening of the posterior nares is two inches deep, and about one inch wide. Its open rounded palatine end is placed some distance behind the last molar. Thus in position it agrees with its hitherto believed ally the Chiru Antelope; but in shape it disagrees, reverting to the ovine postnarial form. The anterior narial aperture of the Saiga, compared even with its own large posterior narial passage, is of excessive proportions, quite $1\frac{1}{2}$ inch across, and between 2 and 3 in depth; inferiorly the bone is smooth-surfaced.

The slender columellar vomer (*Vo*), whilst vertically high, is remarkably short antero-posteriorly; and its palatal attachment neither advances to the anterior narial aperture nor recedes to the posterior one. The spheno-rostral part, however, is well seen behind; and in the live animal the anterior bony septal deficiency is made up for by cartilage and soft membranous substance. It is curious, though, that, excepting above, the vomer anteriorly is not grooved nor has everted lips, as is the rule in Ruminants.

The squamous portion of the temporal bone (*Sq*) has a low smooth-surfaced longish elliptical figure, its anterior angle abutting against the alisphenoid. The zygoma arises by a thin broadish horizontal piece, scooped out at its root above, and perforated by a wide foramen; and as the bone arches forward to unite with and overlie the jugal, it thickens. The glenoid (*gl*) or articular surface is pretty convex, and, with a shallow postglenoid sulcus, much narrower than in Antelopes generally; and the large postglenoid foramen still further reduces it. The articular eminence or tubercle is small, but well marked. The auditory meatus (*au*) has a moderate diameter, and is directed very gently upwards and forwards. The styloid process or plate is short; and the fossa for the attachment of the articular portion of the stylohyal is likewise as in Sheep, small.

The mastoidal eminence is not nearly so full and prominent as in most Bovidæ; it nevertheless rises in a pronounced roughened ridge, which, however, is scooped out towards the root of the paramastoid. The tympanic bulla (*Ty*) is rather well developed, and moderately inflated.

The paramastoid process (*Pmd.*), one inch long, descends almost vertically; seen from behind, it is laterally compressed, with a slight outward obliquity of the posterior border; but from the side, is flat and V-shaped, and partially rests against the tympanic. A wide, deep excavation intervenes between the paramastoid and the condyle; and this cavity narrows to a curved fissure betwixt the tympanic and basioccipital bones.

A narrow strip of the supraoccipital (*So*) forms the hinder portion of the top of the skull. Its lambdoidal suture, in the Society's male specimen, runs transversely with a double forwardly convex curve, this being straighter in the Hunterian skeleton. The superior curved line describes a full arch, is rough, and only moderately prominent; an inferior curved line, less marked, is well nigh obsolete. An external occipital protuberance is but very partially denoted, although the spine is broad and well developed.

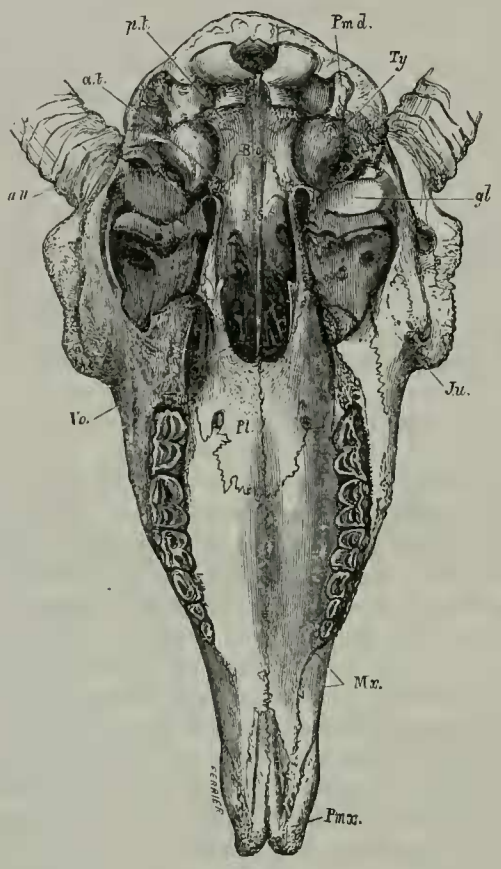
The hollows to which the long muscles of the neck and the ligamentum nuchæ cranially fix themselves are distinctly and separately impressed, giving a rugose surface to the occiput, which is altogether broadly arched. The supraoccipital facies is neither so bulging as in Antelopes and Goats, nor so perpendicularly scooped as in Deer It agrees more, therefore, with Sheep, but in the male Saiga has not such strong ridges and concavities as in the thicker-necked Ram.

The articular condyles of the exoccipital (*Eo*) have each a transverse ungulate figure, which, convex from before backwards and laterally, is yet less prominent or posteriorly sustained than in the Antelopes, coinciding rather with Sheep and Deer. The nearly circular or slightly transversely oval* foramen magnum pertains to *Ovis* in its moderate diameters. Divergently forwards from the inferior root of the condyles, two transversely ridged, large-sized eminences stand out (*p. t.*), these in disposition and breadth following the type of

* Decidedly ovoid in the Cambridge female skull examined by me.

Cervus. They correspond to Turner's* so-called posterior tubercles of the basioccipital. The basioccipital bone (*B o*), an inch long and very nearly as much broad, is slightly bayed on either side, though somewhat broader in front; and is furnished with two additional anterior, externally salient and roughened capitula, Turner's anterior tubercles (*a. t.*). The basioccipital itself is flat, or has only a very lightly raised mesial linear ridge; and in this feature, as well as continuousf ore breadth, nature of the anterior tubercles, and narrow fissure between these and the tympanics, decidedly conforms to what obtains in *Ovis*.

Fig. 6.



Base of the skull of the adult male, reduced less than three-sevenths nat. size, as is fig. 5.

B o. Basioccipital. *p. t*, posterior, and *a. t*, anterior tubercle of basioccput. *Pmd.* Paramastoid. *Ty.* Tympanic. *gl.* Glenoid. *B s.* Basisphenoid. *au.* Auditory process. *Vo.* Vomer. *Ju.* Jugal. *Pl.* Palatine (horizontal plate). *Mx.* Maxilla. *Pmx.* Præmaxilla.

The basisphenoid (*B s*), unusually wide, flat, or linearly raised like the basioccipital, diverges at an obtuse angle from that bone,

* P. Z. S. 1850, p. 167.

and only narrows towards the rostral insertion of the vomer, where it is convexly ridged. The long lamellar external and internal pterygoid plates are so closely conjoined as to be with difficulty recognized as separate elements. The former, lanceolate, and $\frac{1}{2}$ inch in greatest breadth, springing in front of the sphenoidal foramen, does not, as in *Capra* and *Ovis*, trend so horizontally forwards, but strikes more obliquely down, and suturally connects itself with the vertical palatine plate. Its posterior edge agrees with the Antelope's in being narrow, and not everted, as in Sheep and Goats. The latter, internal spheno-pterygoid plate is even more delicate at its root, and arises close to the posterior edge of the pterygo-palatine plate, thence running backwards at a sharp angle to the external pterygoid plate, lays like a splint inside it, and again curves forwards, to be prolonged into a thicker but nevertheless slender rod, terminating in a short hamular process. The alisphenoids, as in *Ovis*, present only a rudiment of that bony plate so conspicuously developed forwards at the back of the orbit in *Pantholops* and other of the Antelopes. The sphenoidal wing in Saiga is altogether small, obliquely ridged, contracted antero-posteriorly, and curved sharply backwards between the postfrontal and squamo-temporal elements. The orbito-sphenoid seen from below has a larger superficies than the alisphenoid, though in itself small. It has a smooth concave surface, the foramen opticum obliquely penetrating it just above the root of the internal spheno-pterygoid plate.

(C) *The Mandible.*—The dentary portion of the body of the bone, when the mandible is placed in natural position, has a moderate curvilinear direction upwards and forwards. At the last molar its vertical depth is $1\frac{1}{2}$ inch, but, correspondingly, less than 1 inch at the premolar. Anteriorly the diasteme narrows very considerably in a tapering manner, and then widens into a somewhat scooped or shovel-shaped symphysial part, 1 inch long and as much wide, into which the horizontally placed incisors are inserted. A diminutive ridge runs backwards from each outer incisor towards the molar alveolus. The mental foramen is situated, outside, immediately behind the symphysis. The ascending ramus, as mentioned, strikes upwards at nearly right angles to the dental plane, the angle being produced as a thin but broad and rounded sweep of bone. The head of the condyle is short-necked, the articular surface transversely oblong and very gently concave. The sigmoid notch is shallow and narrow, the long coronoid process of nearly uniform breadth throughout.

The inferior maxilla in the male measured $7\frac{1}{2}$ inches horizontally from symphysial extremity to ramal angle; and adding an inch for the median incisors, the extreme length would be 8 inches.

(D) *Dentition.*—In the Society's adult male specimen the set of teeth were deficient in the anterior lower premolar and two middle incisors. I found the skeleton at the College of Surgeons more complete, and answering to Pallas's brief statement of the dental numbers in the full-grown animal. The formula, therefore, of the permanent dentition is that of other hollow-horned Ruminants, to wit:—

$$\text{I.}\ \frac{0-0}{3-3},\quad \text{C.}\ \frac{0-0}{1-1},\quad \text{P. M.}\ \frac{3-3}{3-3},\quad \text{M.}\ \frac{3-3}{3-3} = 32.$$

The above author observes "*molares utrinque 5 in junioribus.*"

The extreme length of each series of the grinding-teeth above and below is 2·7 inches. The palatal breadth or distance between the two hindermost upper molars is 1·6, and betwixt the opposite anterior premolars 1·1 inch. The pattern of the teeth, as might be anticipated, is bovine, although they do not strictly conform to any special genus; for instance, the upper molars are sheep-like, the premolars rather antilopine, and the incisors a modification of both.

The maxillary premolars are altogether small—the two anterior particularly so; but the third is somewhat larger. The first is single-, the second double-, and the third triple-rooted. Measured seriatim they have individually a breadth of 0·2, 0·3, and 0·4 inch, and a transverse diameter of 0·18, 0·2, and 0·3 inch. Their external longitudinal enamel ridging is but moderately developed, the third premolar being comparatively smooth-surfaced, or with only a slight development of the anterior ridge.

The three true molars behind these together occupy a space of 1·8 inch long; and they increase in size from the first to the third. As in the Bovidæ, their antero-posterior is greater than their transverse diameter; in other words, their breadth is greater than their thickness. Nevertheless they are stout, and relatively and absolutely thick, indeed much more so than obtains in Antelope-skulls of corresponding dimensions. The enamel layers are of considerable density. The two outer depressions are remarkably shallow and broad, and the bounding longitudinal enamel ridges very moderately elevated—notably so in the last molar, its anterior ridge alone being well marked. On the crown the semilunar vertical enamel folds are simple, with a medium-sized cleft or valley; no trace of secondary folds exists. Internal accessory enamel columns, as in the Ox, and supplemental lobes, are wanting.

The crowns of the three upper molars have the following dimensions:—The anterior 0·5, the penultimate 0·7, and the posterior 0·8 inch broad, and each is about 0·4 inch in greatest thickness or transverse diameter.

The lower incisors and canines closely set together form a fan-shaped expansion 1·7 inch wide; they are not entirely procumbent, but rather tilted obliquely forwards and upwards. The canines or outermost of the four on each side are the smallest; and the incisors progressively increase in size from without inwards. Their outer edges overlap the median incisor, being lowest. The incisors are all more or less spatulate, with a sharp cutting-edge; their upper outer border, where the neighbouring tooth overrides, is slightly ridged; and from the summit the surface shelves to either side. The largest, innermost incisor is moderately expanded at the summit, the others less so.

A long slender diasteme precedes the mandibular molar series. The first premolar present, situated at the uprising of the ridge, is almost conical, and very small. No trace of its whereabouts could be detected in the mandible of the Society's older animal; and in the skeleton of the wild Saiga at the College of Surgeons, on one side it

was very rudimentary; so that I am inclined to think this tooth is lost comparatively early in life. The succeeding premolars, 2 and 3, are of fair size, being a trifle broader, though not quite so thick, as the upper premolars 1 and 2, with which they come into contact during mastication. These latter are short; and the former accordingly are lengthened and raised somewhat above the plane of detrition, chiefly however mesially. The said two hinder lower premolars are each sinuous in contour, from the tolerably pronounced character of the enamel ridges and concavities. The last has well-defined lobes, and is rather larger than that in advance. Together they are 0·6 inch broad, and about 0·2 thick.

The hindermost inferior true molar, quite 1 inch broad and 0·3 inch greatest thickness, has, as in Bovines, a third posterior lobe, of larger size. The penultimate molar is 0·6, the antepenultimate 0·5 inch in antero-posterior diameter, and they are each slightly narrower across than the last tooth of the series.

(E.) *Comparison of the Cranium and Dentition* —"Sceleton, maxime quoad cranium, singulare est"*. These few words of Pallas comprehend much. When Dr. Falconer† wrote that "in the *Sivatherium* we have a Ruminant connecting the family with the Pachydermata, and at the same time so marked by individual peculiarities as to be without an analogue in its order," he was at too remote a distance from brother naturalists or easy access to libraries; else he he would at once have recognized in the *Antilope saiga* certain of those *outré* features which he and Captain Cautley so graphically describe in the Murkunda fossil. Other, later writers have not failed to note resemblances. In the Saiga, unquestionably, we have a repetition of the short nasals of the Sivathere, and large size of the nasal échancrure; but with these peculiarities further likeness ceases, unless it may be that the lachrymal and præmaxilla bore analogy; these, however, the state of the fossil specimens does not admit of comparing. The *Titanotherium proutii* of Professor Leidy‡ and *Megacerops coloradensis* of Dr. Linz§, are representative of two ancient North-American forms which obviously have relations to the above, inasmuch as thickness and diminished length of nasals predominate. The form of teeth in the first two of these fossils is unlike that in *Saiga*; those of the third are not known. All three, as well as the allied *Bramatherium*, are furthermore distinguished from *Saiga* in their possessing four horns, the anterior pair prefrontal.

When we come to compare existing Bovidæ with that under consideration, none have such short nasals, premaxillaries, and scooping out of maxillæ. In these respects there is no connexion whatever with its associates *Gazella*, *Procapra*, *Pantholops*, and *Cervicapra*.

In *Pantholops*, however, as in *Eleotragus* and *Rupicapra*, the

* *Op. cit.* p. 44.

† Asiatic Researches, vol. xix. (1836), and, with additional MS. notes, in Dr. Murchison's collected edition of his works, 1868.

‡ The Ancient Fauna of Nebraska, p. 72.

§ Acad. of Nat. Sci. Philadelphia, Meeting for Jan. 1870.

præmaxillæ fall short of the nasals; but in all these Antelopes, the latter bones abut to a considerable extent against the maxillæ.

In the limited section of Caprine Antelopes of Gray, Ovine Antelopes of Turner, *Capricornis*, *Nemorhædus* and *Budorcas*, the nasals are but of moderate length, the premaxillaries do not reach them, and the maxillæ barely coalesce nasally. In some Oxen, *Bubalus* and *Bibos* to wit, and also in the aberrant Sheep *Ovibos*, the premaxillary stunting is marked, but the relation of nasals to maxilla is quite different from the peculiar one in *Saiga*.

The complementary changed relations of the facial bones of *Saiga*, and especially the increased height but antero-posterior shortening of the lachrymals, differ quite from the modern Ruminant skull, where, as a rule, the horizontal is greater than the upright breadth in the latter bone. Besides these major differences, the Saiga recedes from supposed alliance with *Gazella* and *Cervicapra* in absence of suborbital fissure—though, exceptionally, the Chiru agrees with it in wanting a fissure; but it differs from each in the very slight impress of suborbital fossæ.

Indeed, within certain limits, it may be said that the suborbital fossa of *Saiga*, though wider, has more the shallow roundish character of that of Sheep than Antelopes. The opposite of this remark applies to the masseteric ridge, as the higher position of the Antilopine orbit gives increased length of ridge, as in the Saiga.

Goats, with their elongate fissure, and Deer, with a most extensive wide one, and very deep lachrymal fossa, are remote in facial construction from the type in question.

The group which Dr. Gray designates "Antelopes of the field," including *Antilope*, *Gazella*, *Tetracerus*, *Cephalophus*, and other genera, and the same author's "Antelopes of the Desert," *Alcephalus* &c., have all large, more or less inflated tympanic bullæ. It is to the former of these groups that the Saiga has been assigned; and the development of its ossa tympani in a fair degree shows derivation from it, or unity of stock. In the Society's specimen the bullæ are rather more inflated than in the skull at the Hunterian Museum; and both are fuller and not quite so laterally compressed as in the so-called Cervine Antelopes, *Ægocerus*, &c. The Caprine Antelopes are still further removed, judged of by this single character; for in them the tympanics are moderate and compressed.

The triangular, horizontally elongated and ridged tympanic bones of the Goats and the Deer even more markedly deviate.

In Sheep, as Turner observes, there is a small auditory bulla; but I find in *Ovis vignei* that the bulla is not only of moderate, but indeed of fair size, and quite equal in relative magnitude to that of the Saiga, its shape rather more elongated, but not unlike the latter.

The centre point of the skull, the basioccipital bone, forms a good diagnostic mark between the Antelope groups, especially when taken in conjunction with the tympanic elements and disposition of the facial bones. Usually the basiocciput is longish and narrow, high, convex, and mesially grooved antero-posteriorly. Continuous

ridges bound the groove; and in front and behind a pair of large prominences or tubercles are developed. In the true Ovine, Cervine, and Caprine Antelopes these parts present varied grades of development. The genus *Oreotragus* alone has a tendency to flattening, and *Nemorhœdus* evinces relative broadening of the bone.

In the Sheep and the Goats the basilar bone assumes a totally different form; it is as broad as it is long, widest in front, flat or slightly concave, the posterior tubercles small, and the anterior ones extended onwards rather than highly raised. The same bone in the Saiga, as previously described, essentially resembles these.

The Rocky-Mountain Sheep, *Ovis montana*, offers analogy to the Saiga in having an outer mastoidal depression at the root of the paramastoid. This, partially, is the condition met with in some Oxen; but in Goats there is a great mastoidal eminence: in the Antelopes and Deer it is also convex, but less elevated.

The Saiga, in the backward extension of its horizontal palatines, width of postero-nares, and long, vertically high spheno-pterygoid plates, is interesting, as this is not witnessed to the same extent in living Ruminantia. The short and higher rounding of its skull is also met with in the Chamois, *Æpyceros* and *Damalis*.

There is something peculiar in the dentition; absence of supplemental lobes separate it from the Cervine Antelopes and all Deer; but the teeth might belong to the Gazelle group, though as closely Ovine in character. In its subequal incisors, however, it is unlike the antilopine section that have the median ones extra large and expanded at the summit.

Altogether, the cranial anatomy of *Saiga tartarica* has for its groundwork a basioccipital derivatively modelled from Sheep-structure; to this are added mastoid, auditory, and tympanic elements modified between those of *Antilope* and *Ovis*. The rest of the broad basis cranii, palatal region, and the foramina are built typical of Sheep, but correlated with change of cranial form. The upward set of the basisphenoid and the postcranial contour incline to those of Goats, though the glenoid articulation and posterior border of the maxilla are truly Antilopine.

The horns and interfrontals pertain to the latter group in shape; but the diaphanous corneous texture, as the older naturalists did not fail to observe, are restrictedly Bovine. Forasmuch as stout abbreviated nasals and præmaxillæ indicate family connexion, the Elk and Oxen show a tendency to agreement with Saiga; but the facial region, notwithstanding, by no means approximates close, and rather, in the latter, denotes ancient Sivathere parentage. In fine, the extraordinary-looking soft structures of the nares and the coordinate adaptation of these with deficiency of osseous framework, as in the Tapirs and other Pachyderms, point to physiological function of the nasal region of a kind different in the extreme from the ordinary living Ruminant type. That in by-gone ages kindred proboscidian Ruminants were more numerous, and varied concomitantly in cranial characteristics, the fossil remains attest.

3. *Bones of the Extremities.*

(A) *Scapula and fore limbs.*—Whilst the shoulder-blade shows no special specific or generic mark, it yet, I would say, is impressed more with Antilopine than Ovine form. This, I think, is owing to its somewhat greater length to breadth and upturned axillary border. Its long diameter is 7, and breadth at vertebral end $3\frac{3}{4}$ inches. The supra- is about a third of the breadth of the infraspinous fossa; the spine has a concavity towards the latter; the acromion process is obsolete, a tubercle of bone alone representing it. There is a well-marked neck, flattish and widened by a flange of bone at the axillary border. The glenoid cavity is shallow, incised at the coracoid end, this process being short and broad. The tricipital border is thick, wide, and markedly grooved, and towards the vertebral end rises at a right angle to the plane of the infraspinous fossa in a prominent strong plate of bone for the attachment of the teres major muscle. The cartilage at the spiual end was semiossified in the male specimen.

The shaft of the humerus is roundish, but with a tendency to posterior angularity. Head and neck relatively to the shaft are massive. The great tuberosity is very broad, strong, and thick, obliquely salient inwards. The deltoid eminence and elevation for attachment of the teres major are each well developed. The bicipital groove is flattish and unusually broad. The articular capitulum is deflected posteriorly, its upper surface being moderately convex and broad; the inferior extremity presents little or no difference from that of the Sheep.

There is a moderately broad shaft to the radius, which has a slight bend forwards, and, as usual, is convex in front, but almost flattened behind. The stout olecranon rises 2 inches above the radius; and the shaft of the ulna is represented by a slender rod continued to the short styloid process, where it somewhat widens out.

The carpal bones consist of the usual ruminant number, 6, viz. the scaphoid, semilunar, cuneiform, and pisiform in the first row, and os magnum (with united trapezoid) and unciform in the second. Proximately the scaphoid, lunar, and cuneiform are arranged in a close-fitting semilune, the pisiform bone being, as it were, accessory, placed posteriorly and comparatively free. The magnum and unciform form an inferior and reduced semilune, modelled accurately to the upper surface of the metacarpal pillar. A sufficient hollow is provided behind these bones for the tendons &c. to be bound firmly by transverse ridges of fascia, and enabling them to play with security during the frequent jerking movements of this part of the limb when in action.

The scaphoid, of good size, has an upper deepish median hollow which lodges the greater part of the inner facet of the radius. The said hollow is somewhat laterally constricted, but posteriorly rises as a tuberosity. The underside of the scaphoid occupies more than the outer moiety of the connate os magnum and trapezoides. The uneven outer side of the bone rests in the corresponding rough concavity of the lunare.

The lunare or semilunar bone has a figure-of-eight shape, but with numerous prominent angular facets. It is smaller than the scaphoid. The proximal surface articulates chiefly with the median fossa of the radius and the crest on the outer border of the inner facet. Its lateral constrictions are filled by the corresponding eminences of the scaphoid and cuneiform. Distally it presents two small flattish quadrangular facets, and behind these a couple of grooved ones; these coincide with the approximate parts of the magnum and unciform.

The cuneiform offers two angular faces, which wedge into the neighbouring concavity of the lunare. Proximally the cuneiform articulates by a raised portion with a small part of the radius; and outside this there is a deep oblique groove for the reception of the styloid process of the ulna. The distal surface rests solely upon the unciform bone; a posterior outer and downward process rests in the fossa on the outside of the unciform.

The long diameter of the pisiform is vertical. It is a rather large, ovoid, convex, and laterally compressed bone, the inner surface being deeply grooved for the transmission of tendon.

The os magnum differs from all the bones of the row in being relatively thin, flattish, wide and diamond-shaped. The upper surface is quite level on the outer half for the reception of the scaphoid; and on the inner half it presents fore and aft facets, upon which, as aforesaid, those of the lunare rest. Its articular surface with the unciform is concave. The metacarpal articular surface is quite a horizontal plane, except the trapezoidal portion, which is rather more indented. The homologue of the trapezoid bone is only indicated by a tuberous condition of the inner posterior angle of the magnum.

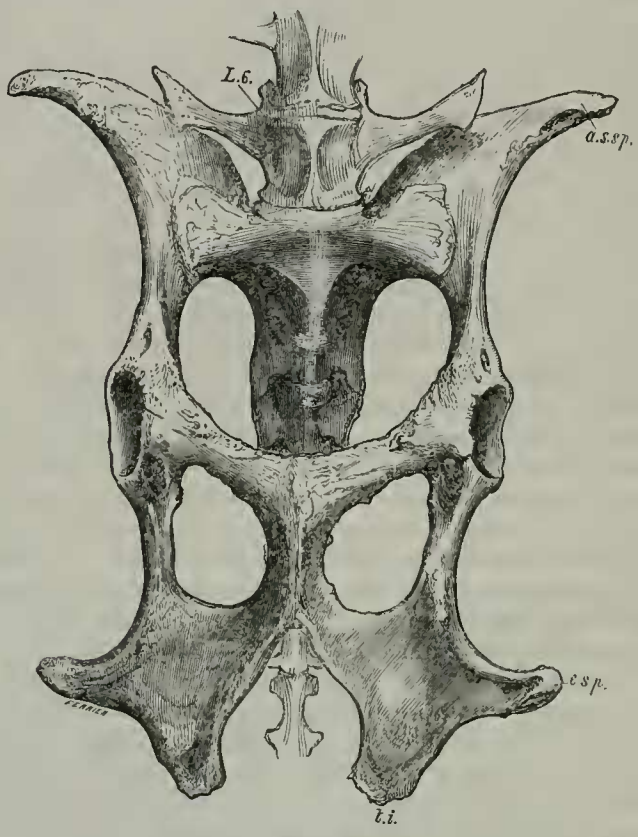
The unciform, like the magnum, has a very smooth under surface, which plays on the proximal end of the fourth metatarsal (*i. e.* the outer one present). The upper surface of the bone is uneven, and possesses several facets at different angles and planes, which articulate with parts of the lunare and cuneiform. That fossa outside, wherein the descending process of the cuneiform lies, is well marked.

The cannon bone is a long and beautifully finished pillar, a slight mesial groove indicating third and fourth metacarpal elements. A nutritious foramen penetrates the bone at either end of the said furrow. A delicate spicular rod of bone $2\frac{1}{2}$ inches long, and representing a second metacarpal, is seen in the College of Surgeons' skeleton; this must either have been cut away or was absent in the Society's specimen. Behind the digital end of the connate metacarpals are two pairs of large-sized sesamoid bones, each pair appositely placed with a median groove for the long flexor tendons. Futhermore, in the Hunterian specimen three additional free and minute ossicula have been preserved; of these, two are placed on the inner and one on the outer side of the metacarpo-phalangial joint.

The phalanges, proximal, median, and distal, are of fair strength, and, all more or less, laterally compressed. The last or ungual digits are comparatively short and high. Behind the lower extremities of the second phalanges two large sesamoids are met with.

(B) *Pelvic arch and hind limb.*—In treating of the male pelvis it may be as well to mention that the left ischium of the Society's specimen had sustained a fracture, the parts being reunited in a contorted manner. The opposite right pelvic moiety, however, was intact; and from it and the College of Surgeons' skeleton the subjoined description is taken.

Fig. 7.



Pelvis of male adult Saiga, its lower aspect: two-fifths nat. size.

L. 6. Last or sixth lumbar vertebra. *a. s. sp.* Anterior superior spinous process. *t. i.* Tuberosity of the ischium. *e. sp.* External spinous process of ischium.

The brim is placed at an angle of about 50° to the long axis of the lumbar vertebræ. Its conjugate diameters are 3 inches; no marked inequalities exist, so that its roundish outline is complete. The enlarged diamond-shaped blade of the ilium is deeply biconcave without for the deep gluteal muscles; and the sacro-iliac synchondrosis occupies rather less than half of the antero-inner convex surface. A remarkably prominent, elongate anterior superior spinous process (*a. s. sp*) juts outwards; and the middle of the crest has also a noteworthy tuberosity. The acetabulum is narrow, but deep, the notch large but protected by a thick layer of cartilage. The anterior

or superior limb of the os pubis is stouter than the posterior one. The symphysis, roughened and protuberant in front, is continued backwards, carinate; the pubic arch is very deep, narrow, and ∧-shaped. Each obturator foramen is widely subcircular. The body of the ischium is thin, with a very sharp superior (or posterior) border, its spine forming a wide upward sweep in the bony curvature. The combined tuber ischii (*t. i.*) and ramus, flattish below and mesially ridged above, have a reverse plane from the body of the ischium; namely, they are horizontal and widely expanded in a trefoil shape. The inner plate or ramus, the thinnest, joins the pubis; the posterior tuberosity is thick and bulbous; and the third outer spur, which I designate the external tuberosity (*e. sp.*), has an intermediate thickness and breadth. An angle of 75° approximately gives the separate plane between the iliac and the ischio-symphysial axes.

From within outwards the neck of the femur is very broad, but exceedingly short, it and the head being antero-posteriorly flattened. The articular surface of the latter, consequently, is of a transversely oval shape, depressed, and almost at right angles to the axis of the shaft: a roughening indicates the round ligament. The intertrochanteric fossa burrows deeply at the root of the great trochanter, and from that inwards is more open. The great trochanter is large, and posteriorly rises ¼ of an inch higher than the head; its gluteal surface has a long subquadrate outline. Relatively, the trochanter minor is small, and, as in other Ruminants, a third trochanter is wanting. The shaft has a slight forward axial bend; and a long but feebly developed linea aspera descends its whole length on the postero-outer side. The condyles are large and subequal in size; the intercondyloid space narrow and shallow.

With reference to the patella, it is short, stout, and of a nearly equal-sided triangular figure. Its articular surface is but slightly convex. In the fresh condition of the parts the eminence of the outer border is heightened by a wall of cartilage: the prominent ridge thus produced overlaps and grasps the anterior articular rim of the internal condyle, allowing of an upward and downward gliding movement, and preventing luxation from side to side.

The articular crown of the tibia is heart-shaped, but with a deep incision for the tibialis-anticus tendon on its outer border towards the front. This causes the outer, fibular moiety or condyle, which superiorly is the more convex of the two, to be shorter than the inner one; whilst it is also the broader, and has a posterior deep-based margin. The tubercles for the crucial ligaments are well developed. The anterior tuberosity is large, though laterally compressed, sharp-edged; and, from being three-sided and of considerable magnitude above, the shaft narrows and is roundish in its lower two-thirds. The muscular grooves are well marked.

Nothing can exceed the compact interlocking, yet easy, ginglymoid movement devised between the distal articulation of the tibia and calcaneum, all chance of lateral dislocation being prevented by the strong internal malleolar plate and the guard of the external side, which is the inferior fibular segment presently to be spoken of.

The remnant of, or aborted fibula, as in other Ruminants, is represented by a short stalactic process of bone depending from the external tibial tuberosity, and by a small subquadrate-shaped bone impacted along with the tarsal elements at the tibial distal extremity; the latter, as above said, takes the place of an outer malleolus.

The tarsus is composed of five separate bones, and a sixth if the fibular distal appendage or separate tarsal-like end be included. These altogether are not so stout as in the Sheep or Chamois.

The calcaneum is strong, of moderate length and thickness, and somewhat more than usually narrowed in cross thickness. It mainly articulates with the astragalus; but there is a facet which rests upon the upper surface of the cuboid portion of the combined naviculo-cuboid bone, and another for the infrafibular ossicle.

The astragalus has the ordinary Ruminant type, but relatively is of small size, though its ligamentous pits and impressions are deepish. Its distal articulation is chiefly with the navicular portion of the scapho-cuboid.

This combined scapho- or navicular cuboid bone is deep compared with its size. Its upper surface, or face of articulation with the astragalus, is biconcave and considerably scooped out.

The single metatarsal shows little or no sign of segmentation. Like the metacarpal, it is of considerable length, but much the more laterally compressed, or its antero-posterior diameter is the greater. This fore-and-aft depth decreases from above downwards, and at the base or distal end becomes altered, so that it is broader across than from front to back. The upper two-thirds of the posterior surface is fluted; and at the top of the groove there rests a small sesamoid bone. The trochlear or digital articular eminences are deep, but not wide. Two pairs of sesamoid bones, affording pulley-superficies for the flexor tendons, lie behind the distal enlargement.

As regards length, lateral compression, shape and number, the digits and phalanges of the hind foot agree closely with those of the fore foot.

(C) *The limb-structure compared.*—In reviewing the appendicular structures I may, first, refer to the Table which I have drawn up to exhibit the comparative lengths of the limb-segments in a series of Ruminants. (See p. 475.)

Saiga is there placed alongside the Sheep. The numbers attached to the names refer to the individual skeletons in the College of Surgeons' Museum, from which these measurements were taken. A single species of each group may serve for comparison, though of course this implies approximate rather than exact inferences.

With regard to greatest breadth of scapula to its length, allowing the long diameter to be represented by 100, these are as undernoted:—

38·1 Giraffe.	59·8 Bull.	68·0 Sheep.
56·4 Goat.	60·0 Saiga.	68·1 Musk-Deer.
59·0 Gazelle.	67·1 Fallow Deer.	69·6 Llama.

These proportions, added to the general appearance heretofore men-

	Bovidæ.		Ovidæ.			Capridæ.		Antilopidæ.			Cervidæ.			Giraffidæ.	Moschidæ.	Camelidæ.		
	Italian Bull (3825, A), *Bos taurus.*	White-tailed Gnu (3808), *Catoblepas gnu.*	Sheep (3751), *Ovis aries.*	Nahura Argali (3779), *Ovis nahura.*	Saiga (3729, A), *Saiga tartarica.*	Goat (3736), *Capra hircus.*	Nepaul Goat (3748), *Capra nepalensis.*	Equine Antelope (3696), *Ægocerus equinus.*	Gazelle (3648), *Gazella (Antilope) dorcas.*	Chickara (3715), *Tetracerus quadricornis.*	Roe Deer (3598), *Cervus capreolus.*	Fallow Deer (3536), *Cervus dama.*	Reindeer (3112), *Tarandus rangifer.*	Giraffe (3617), *Camelopardalis giraffa.*	Musk-Deer (3490), *Moschus moschiferus.*	Vicugna (3489), *Auchenia vicugna.*	Llama (3482), *Auchenia llama.*	Camel (3445), *Camelus bactrianus.*
Scapula	17·2	11·2	7·2	6·0	7·2	6·2	6·8	13·3	4·4	4·9	5·0	7·6	8·1	22·3	4·4	7·2	8·9	14·7
Trans. diameter at base ...	10·3	5·0	4·9	4·2	4·2	3·5	3·7	7·2	2·6	2·2	3·5	5·1	5·5	8·5	3·0	5·2	6·2	9·3
Humerus........................	13·0	8·5	6·0	6·2	6·1	5·8	6·9	10·4	3·9	4·7	6·0	6·9	8·3	13·1	5·7	7·6	9·2	
Radius..........................	13·2	10·9	7·0	6·5	7·0	6·0	7·9	14·0	5·0	5·5	6·5	7·8	9·7	27·5	5·1	9·2	11·0	17·6
Ulna	17·2	13·5	8·5	8·5	8·8	7·8	9·7	17·0	6·2	7·0	8·0	10·0	11·8	32·6	6·2			
Metacarpal	9·2	7·9	5·7	5·2	6·2	4·1	5·6	11·1	6·0	5·5	6·3	7·7	7·2	25·0	4·2	7·8	8·8	13·2
Proximal phalanx	3·0	2·2	1·6	1·5	1·8	1·4	1·7	2·7	1·3	1·4	1·6	1·6	2·1	4·7	1·3	2·2	2·8	3·6
Femur...........................	17·5	10·5	7·9	8·3	7·9	7·3	8·6	13·2	5·6	5·7	7·3	9·4	10·4	19·6	6·8	10·4	12·3	17·9
Tibia	16·2	12·0	9·5	9·8	8·8	8·3	10·1	15·4	7·2	8·1	9·5	10·2	12·0	22·6	8·4	10·7	12·6	15·3
Metatarsal	9·7	8·6	5·8	5·6	7·0	4·4	5·7	11·5	6·2	6·1	6·3	8·5	10·4	25·6	5·5	7·7	8·9	12·9
Proximal phalanx	2·7	2·4	1·6	1·6	1·5	1·4	1·7	2·8	1·2	1·4	1·4	1·7	2·1	4·2	1·4	2·3	3·0	3·0

tioned, characterize the blade-bone as Antilopine rather than Ovine or Cervine.

It is difficult verbally to define differences in the long limb-bones of animals disagreeing in size but with such similarity of construction as obtains in the subsidiary groups of the Bovidæ. The relation of the segments to each other possibly is the most satisfactory test. From such a standard, in Ruminants generally, the following results appear:—

Proportion of the radius to humerus, the latter equivalent to 100.

89·4 Musk-Deer.	113·0 Fallow Deer.	119·5 Llama.
101·5 Bull.	114·7 Saiga.	128·2 Gazelle.
103·4 Goat.	116·6 Sheep.	209 9 Giraffe.

The Giraffe towers in radial length. The Gazelle, typical of the Antelopes, follows, with, however, great diminishment of the radius, yet considerably removed from *Saiga*, which, with the Sheep and Deer, take an intermediate position in the above Ruminant scale. The aberrant *Moschus* is in extreme from the equally abnormal Giraffe.

Proportion of the metacarpal to radius, the latter equivalent to 100.

68·3 Goat.	81·4 Sheep.	90·9 Giraffe.
69·6 Bull.	82·3 Musk-Deer	98·7 Fallow Deer.
80·0 Llama.	88·5 Saiga.	120·0 Gazelle.

As regards proportion of cannon bone to radius, Sheep and the Saiga again occupy a middle place, and the Gazelle far exceeds these, the Cervidæ, and even the long-fore-legged Camelopard.

Proportion of tibia to femur, the latter equivalent to 100.

92·5 Bull.	111·3 Saiga.	120·2 Sheep.
102·4 Llama.	113·7 Goat.	123·6 Musk-Deer.
108·5 Fallow Deer.	115·3 Giraffe.	128·5 Gazelle.

The Saiga, in its femoro-tibial segments, departs from *Ovis*, and is widely separate from *Gazella*, its alliances, as in the fore limb, being with *Cervus* and *Capra*. The changes in relationship of the Giraffe, Musk-Deer, and Llama are not a little remarkable.

Proportion of the metatarsal to tibia, the latter equivalent to 100.

53·0 Goat.	65·4 Musk-Deer.	83·3 Fallow Deer.
59·8 Bull.	70·6 Llama.	86·1 Gazelle.
61·0 Sheep.	79·5 Saiga.	113·0 Giraffe.

There is a certain correspondence between the cannon bones of the hind and fore limbs, contrasted with their osseous pillar above, in all the Ruminants selected for comparison. The Giraffe, however, presents the maximum, and not the Gazelle.

Limiting my remarks to the Saiga, it comes out, in whichever light viewed, that this animal, in the proportional lengths of its long limb-bones, has much nearer affinities to Sheep than to Antelopes. This with a certainty is the case in the fore leg, though in the hind leg it has closer agreement with Deer than with either of the said groups.

It is necessary to speak with caution of the inferences deducible from pelvic formation, as sex, age, &c. render data unstable, unless an extensive series are studied side by side. The pelvis of the young female Saiga resembles that of the adult female Red Deer; but the adult male Saiga's does not agree with it. The ilia of most Deer are shorter, the pubic angle wider, the brim is not so round, the symphysial ridge and the ischial tuberosities relatively less pronounced.

Sheep contrasted with Saiga have a more oval contour of brim, their anterior superior spinous processes, external ischial spine, and postischial tuberosity are, as in it, large, yet less produced; the pubic angle is narrow and short. A greater differentiation obtains in the Goat, Ibex, and Chamois, where the bony processes are less developed and the pubic angle is wider.

II. Nasal Chambers and Myology.

1. *The Nares.*

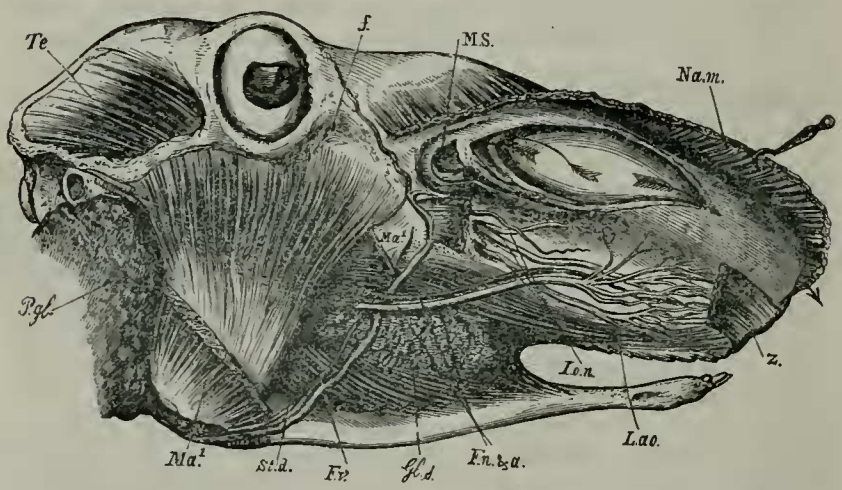
Outer aspect.—The organ, *par excellence*, which first excites attention and gives a peculiar character to the Saiga is its trunk-like proboscis (fig. 12). No existing Ruminant, to my knowledge, is furnished with such an exaggerated nasal apparatus, though some few have the upper lip more than ordinarily elongated. It is, however, to the ample soft narial walls that the Pig-like or proboscidean face is due in Saiga. As in Swine, its extremity is abruptly truncated; but it differs very materially from theirs in being soft and flabby, without a discoid fibro-cartilaginous expanse; and the nasal orifices are very patulous. Neither is the Saiga's nasal enlargement quite after the type of the Elephant and Tapir, where the trunk is provided with a tactile retracting tip. The Horse, again, bears a resemblance to the Saiga in its greatly dilated nostrils, which, however, are more cartilaginous; and its upper lip is much more callous and prehensile.

Externally and in front the nose and muzzle of the Saiga have a semilunar contour, the lip broad, hairy, and mesially grooved, but not deeply fissured. The nares have an extreme transverse diameter of 2 inches, and each is an inch in depth. Each wide nostril is suboval, and, when dilated, inclines upwards and outwards, where it is rather wider than at the septum. This latter exteriorly is moderately thick, but thin interiorly for 2 or 3 inches backwards. The nasal passages are about 4 inches long from the external orifice to the nasal cartilages, 2 inches deep, the width depending greatly upon the contraction of the facial muscles; for the passages themselves are very lax and pliant in the dead body. The accurate Pallas has not passed unnoticed that the floor and outer wall are clothed with longish silky white hairs, and studded with sebaceous follicles, the septum naked, and that there is a peculiar maxillary sac opening within the cavity of each naris.

Nasal sac.—This sac possesses much interest, as helping, with others, to a better understanding of the homology of the Cetacean nasal sacs, which I have treated upon and compared with this else-

where. In the young female the sac and its opening similarly placed (see fig. 8, *M S*) were smaller than in the adult male; but I shall choose the latter for description. It is placed deeply beneath the nasal muscles and tissues, above the premaxillary bone, and vertically under the alar cartilage. It is globular in shape, an inch deep, and with a large vertical ellipsoidal aperture opening into the nasal passage below the anterior inferior margin of the alar cartilage. Interiorly it is lined with an extension of the mucous membrane, and is studded with glands similarly to the hairy portion of the nares. The glands secrete abundantly a sebaceous-looking substance which Pallas says has a rancid goat-like odour; and in this I concur, though in Sheep the smell from the nares is not dissimilar. The inferior turbinal bones and mucous lining narrow the nostril behind the opening of the sac; but it is worthy of notice that a small vertically semilunar depression, $\frac{1}{2}$ an inch long, exists between them outside the turbinal and superior to the orifice of the sac. There is also another much wider fossa or duplication of membrane on the floor of the chamber mesially and in front of the first-mentioned premaxillary sac. In fact, a semilunar membranous fold forms a well-defined step between the raised anterior narial chamber and deeper posterior nares. The soft membranous postseptum is very thick compared with the front part; its vessels are arranged in very numerous obliquely parallel lines.

Fig. 8.



Dissection, head of female Saiga, showing nasal sac and nervous distribution.

M S. Maxillary sinus, or extra nasal sac; a portion of its outer wall is removed, and an arrow from the nares shows the connexion therewith; parts of two other arrows indicate the separate nasal passages. *f.* Suborbital fossa or pit. *Na. m.* Nasal muscles, reflected and partially cut off. *z.* Origin and insertion of zygomaticus. *I. o. n.* Infraorbital nerves. *F. n. & a.* Facial nerve and artery, a dotted line carrying them towards their cranial exit. *P. gl.* Parotid gland; and *Gl. s.* Glandula socia. *F. v.* Facial vein. *St. d.* Stenon's duct. *Ma*[1] and *Ma*[2]. Superficial and deep layers of the masseter. *Te.* Temporalis.

Nasal cartilages.—As has been shown, the lengthened capacious nasal organ of the Saiga is chiefly built up of soft substances, namely muscular, fibrous, and fatty structures, with an internal lining of sensitive, partially hairy, mucous membrane. The cartilages of the nose take but a minor part in its composition. It may be as well, however, that I describe these; and in so doing I refer to figure 5. This will enable the reader to comprehend the relation of the parts at the root of the nose, when the soft nares are removed, the cartilages alone remaining in contact with the bones.

The septum narium (*Sp*) is remarkably long and deep; anteriorly and superiorly it is membranous, the more solid cartilaginous portion, or *septal cartilage*, being limited to a lengthened wedge-shaped splint. This arises from the vomer; trends forwards and downwards on the floor of the nares to the anterior median groove separating the premaxillary bones.

At the summit of the nasal region, above and in front, the septal narial cartilage projects for about an inch beyond the nasal bones. It is narrow and acutely wedge-shaped, the basal end but moderately broad, the point mingling with or being wedged between two elongated fibro-cartilaginous cords (*f*) presently to be spoken of.

The two *upper* and posterior *lateral cartilages* (*Ul*) have each a shallow but widish semilunar contour, and partially fill the irregularly margined concavity betwixt the orbito-maxillary and nasal bones. The anterior horn of the crescent abuts against the median nasal cartilage, and outwardly is bounded by the alar cartilage. The post-infero-horn runs down towards the premaxillary, and by a constricted isthmus joins what appears to represent a sesamoid cartilage, though in strictness this is little other than an inferior continuation of the upper lateral cartilage itself.

The so-called *sesamoid cartilage* (*Ss*) is of small size, narrow, and arciform, and fits into a deepish pit of the bone at the lachrymo-maxillary orifice of the nasal duct, see *, fig. 4.

The *alar* or *lower lateral anterior cartilages* (*Ll*) are the largest and thickest of the three pairs of nasal cartilages. Each possesses an elongated lozenge-shape, or is irregularly diamond-figured. The axis of the long diameter passes in a line nearly parallel with that between the apex of the nasal bones and the inferior border of the orbit, but is fully $\frac{1}{2}$ an inch in front of these. The upper anterior angle of the alar cartilage, as has been intimated, is joined by an anterior slip from the upper lateral cartilage; and the united but produced portion lying outside the point of the superior portion of the septum narium is continued onwards. The pair of narrow cords (*f*), one on each of the median lines, are fibrous in texture and very elastic; and they proceed among the tissues of the summit of the nares, as far almost as the truncated extremity of the nares, laterally dwindling to a delicate film of glistening fibrous tissue. The inferior angle of the alar cartilage is curvilinear, the concavity forward and, broadening slightly below, bends inwards towards the nasal chamber.

It is difficult accurately to define the margin of each of the cartilages as they graduate into thickish fibroid tissue at their free edges. A rough measurement in the male animal gave the following results:—Alar cartilage 2 inches in long diameter by $\frac{1}{2}$ inch at point of greatest breadth; posterior lateral cartilage $1\frac{1}{2}$ by $\frac{1}{2}$ inch in the same diameters, the sesamoid or extension of the last 0·6 long by 0·2 inch at widest.

Separating the alar and lateral cartilages, on both sides of the nares is an elliptical fossa or shallow depression placed almost perpendicularly to the long axis of the cranium. This depression, indicated only by a dark shadow in fig. 5, consists of strongish fibrous tissue, but is filled ordinarily with fatty substance and delicate pale-coloured muscular fibres. These last, as shall hereafter be more particularly pointed out, may be homologous with the levator proprius alæ nasi anterior, and levator proprius alæ nasi posterior, or the true dilators of the nares, although here situated far behind the external narial apertures.

The fibres in question still have the same function in relation to the cartilages of the nose, namely, movement of the alæ. The long fibrous cords conjointly derived from the alar and postlateral cartilages appear to form a superior longitudinal line of support to the soft nasal walls. They, being highly elastic, permit, and indeed assist, the muscular coverings in retracting efficiently.

Sense of smell.—Discussing the parts appertaining to the sense of smell, it here seems appropriate to say a word on such habits of the animal as bear thereon. The nose of Saiga, I find on good authority, is an excellent telltale, as the information my esteemed colleague, Mr. A. D. Bartlett, furnishes me with proves. He says, "One of the difficulties attendant upon keeping the Saiga in good health is its daintiness. Not only is it necessary to find suitable food, but that food must be perfectly fresh and untouched by other animals; for if a mouse, rat, or even a sparrow, feed out of the same trough, or touches the provender, the Saiga will not eat it. So delicate is the sense of its smell, and so carefully must every particle be handled, that I regard it as one of the most dainty feeders I have ever met with among animals during my long experience in these Gardens."

Another circumstance tending to show a keen sense of smell is, that when any disagreeably odorous substance is offered or thrown to the animal it seems quickly to appreciate its qualities. Although its curiosity be excited, it does not approach closely and sniff it, as most Antelopes or Deer would, but remains at a distance inspiring freely with dilated nostrils.

2. *Muscular and other structures of the face and body generally.*

I have explained at length the peculiarities of the internal nares; but the structure of the external walls also demands a few remarks. The soft flabby nature of the proboscis has been alluded to as dif-

fering from that of other animals with a like nasal elongation, as notably the Pig, Horse, and allied Ruminants. The Tapir probably presents the nearest resemblance, minus lengthening and tactile apex; this, as has been shown, is chiefly owing to the shortening of the nasal bones and cartilages. Proceeding, however, with an enumeration of the parts from the superficial towards the deep, I shall state broadly that the muscles, vessels, and nerves closely assimilate in their disposition to those in the common Goat and Sheep; but the development of analogous parts does not quite correspond.

In the Saiga there is a great broad sheet of muscular fibres which arise from the naso-, orbital, and maxillary regions, and, proceeding forwards, clothe the entire surface of the unusually vertically deep nares (*vide* fig. 8, *Na. m*). Posteriorly the fibres are thin, but they acquire bulk as they go forwards and downwards. To the lower border of the above, and, indeed, intimately connected with it, is a narrowed but also thick plane of muscular substance, which springs from the maxillary eminence and goes to the outer inferior side of the nostrils (*z*, fig. 8). Its direction is somewhat obliquely upwards or convergent to the first named. These two muscles respectively correspond to the *levator labii superioris alæque nasi*, and conjoined *zygomatici*. The lower one may also include the *levator labii superioris proprius*, whilst the upper one, in its deep transverse pale-coloured fibres, undoubtedly comprises the homologues of the *pyramidalis nasi*, *compressor naris*, and *dilator naris*.

The last-mentioned three muscles, though most intimately interwoven with the coarser upper layer of the *levator labii superioris alæque nasi*, and in a manner inseparable from it, can yet be readily distinguished, as they are much paler in colour, finer in texture, and set obliquely or at right angles outwards to the narial wall. The alar cartilages, it is true, are situated far back; nevertheless the posterior portion of the dilator naris (or *levator proprius alæ nasi posterior*) is clearly present, filling the deep fissure between the maxillary bone and the curved tapering alar cartilage. The anterior portion of the dilator (*levator proprius alæ nasi anterior*) abuts against the soft walls of the naris. The *depressor alæ nasi*, and so-called *naso-labialis* of human anatomy, cannot be defined.

In the Sheep and Goat the levator labii superioris alæque nasi is very small compared with the Saiga's; and the other deep nasal muscles proper, from the cartilages being carried forwards, are very diminutive indeed in the former animals. The zygomatic and levator labii proprius muscles, however, are coequal, probably even thicker in the Goat, which, as a browser, as Ogilby remarks*, uses its upper lip to a remarkable extent.

The trunk of the Elephant and Tapir, whilst absolutely composed of the same homologous elements, has quite a different appearance when cut into, either transversely or laterally. In them there is a vast accession of prominently marked muscular slips, and glistening interlacing cross fibres intermingled with large blood-

* Trans. Zool. Soc. vol. iii. p. 58.

vessels, which give the whole quite a banded network character; whereas in the Saiga the fibres of the nasal muscles proper and blood-vessels are so minute as to have more of a glandular aspect.

In the Pachyderms the proboscis is as much an organ of touch and prehension as of smell. In Saiga undoubtedly touch or the sense of feeling must be possessed to an unusual degree in this musculo-sensory nasal apparatus. The increase of powers of smell, however, seems to be its office; for the Schneiderian membrane is that which most gains in superficial capacity, the power of retraction and movement, though ossessed by it, being secondary or adjunct.

The distribution of nerves to the outside of this dilated nose-chamber is peculiar, inasmuch as the facial nerve (*F.n.*) is enormously developed. Piercing the parotid gland behind the ascending ramus of the mandible, it traverses, as in Sheep and Goats, superficially across the masseter to above the angle of the mouth, then, directed obliquely upwards and formards, splits into a vast number of thick branches. But the fan-shaped nervous plexus which spread over the entire face are by no means so few or so small as in Ovidæ, compared with which they are of gigantic proportions. While some proceed towards the upper lip, the greater number pass underneath the zygomatic and l. l. s. alæque nasi muscles, and, piercing the deep nasal muscles, ramify finally on the fibrous wall of the nares, both laterally and in front. In fact they similate the nervous distribution on the Pig's mobile and sensory snout; only in Saiga many more go to the lateral aspect of the nares, and comparatively fewer to the extremity of the nose. In most Bovines the infraorbital nerves are large relatively to the temporo-facial; but in *S. tartarica* the reverse obtains (fig. 8, *I. o. n*). This may be accounted for by the upper lip of the former requiring greater nervo-muscular power; whereas in the latter, as has been shown, the nose acquires prominence, being the active sensory and mobile organ.

Among cranio-facial muscles other than those mentioned, the *temporalis* (*Te*), as in Ruminants generally, has a small superficial area. The *masseter* is double; its superficial layer (*Ma*^{1}), broad and thick, arises by a strong tendon from the maxillary prominence, and by fibres from the lower edge of the orbit; posteriorly and below it has a wide insertion into the angle of the mandible. The second, deeper layer (*Ma*^{2}) has more vertically directed fibres; they arise from the anterior half of the zygomatic arch and lower surface of the orbit, and are inserted into the anterior half of the ascending mandibular ramus. The *buccinator* is moderately thick, elongated, and narrowed behind. The inferior labial group of muscles are but moderate in size.

The *sterno-mastoid*, as Owen remarks in the Giraffe, is according to attachment a sterno-maxillaris, each belly posteriorly being in close union with the sterno-hyoidei, and anteriorly ending by a strong tendon, which amalgamates with that of the masseter primus, they together being firmly fixed to the maxillary eminence. This facial

attachment must have a powerful influence in fixing the head upon the neck.

The *pectoralis major* is small compared with the *p. minor*; its origin reaches only to opposite the fourth rib; and its broad insertion is round the fleshy parts at the head of the humerus. The *pectoralis minor* is much more elongate, triangular, and stronger than the *p. major*. It extends backwards to the xiphoid cartilage, and, in partial union on the side of the chest with the latissimus dorsi, proceeds forwards, and is inserted into the head of the humerus above the supraspinatus. As in Ungulata, there is a *sterno-scapular* muscle present. This, a small fleshy band or slip, arises from the anterior outer side of the manubrium, and, passing outwards, goes between the scapula and head of the humerus, being lost in the tissues superficial to the pectoralis minor. A distinct *supracostal*, some inches long, lies upon the first four or five ribs, as in many Ruminants. It is fleshy to the second rib, and broadly tendinous behind that, inclining from without inwards. The *serratus magnus* is both extensive, thick, and fleshy. It is situated between the seventh rib and the axis, its subscapular fold covering the bone from the vertebral border to its middle. The *latissimus dorsi* comes from the tenth rib forward, is relatively narrow, and joins, as aforesaid, the pectoralis minor, to be inserted into the humerus.

The *biceps* is single-headed and strong. The *brachialis anticus* has origin from the post-outer surface of the humeral neck, and, with a moderately fleshy belly, is fixed into the anterior radial head. The *coraco-brachialis* is large and fleshy. Origin coracoid process; insertion to middle of humerus. The long narrow *deltoid* stretches between the lower border of the scapula and the deltoid ridge. The *triceps* is four-headed; and there is, besides, a band-like slip representing the *dorsi-epitrochlear* muscle. The scapular head of the triceps is of enormous bulk; and the dorso-epitrochlear band lies deeply adherent to it. The *supraspinatus* has a partially double insertion on to the head of the humerus, as in the Giraffe.

There is the representative of a *cephalo-humeral*, which rolls round the head of the humerus, and is inserted between the biceps and brachialis anticus and triceps on the shaft of the bone below the deltoid ridge. The long spinal muscles of the back are remarkably broad, well developed, and fleshy; the *psoas* and *iliacus* moderately so, though wide.

There is a thick layer of firm fat overspreading the entire body, but only partially so on the limbs; it lies beneath the extensive muscular panniculus carnosus. The cutaneous *panniculus* is of moderate thickness, and fleshy chiefly on the side of the body. It sends a thin slip towards the elbow; and there is a broad attachment, both into the groin and onwards to the knee-joint.

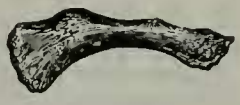
Other muscles have been described, among the organs of generation and laryngeal structures. The remainder of them and the tendons of the limbs were but roughly dissected, as both skeleton and skin had to be prepared for the British Museum.

III. Visceral Anatomy.

1. *Vascular Channels.*

The heart, 4 to 4½ inches long and 2½ inches in diameter at the base, approaches more to the Antelopes' and Deer's in shape than to that of the Sheep. This arises from its being elongate, pyramidal, and taper pointed; for in the Sheep the apex is more blunt and obtuse. The deposition of fat around the basal end and on the pericardium is limited in quantity. A thin ossicle an inch long and ·2 inch broad at its middle, lay within the muscular substance, close to the aortic orifice, in the adult male. The bone, as regards shape, was not unlike a diminutive broad first rib, one end being wider and twisted, like the costal head, the opposite extremity narrower.

Fig. 9.



Bone of the heart—nat. size.

A single superior vena cava and an inferior one enter the right auricle from above and below. The facial veins and arteries (see fig. 8) follow the distribution met with in Bovidæ generally.

That vasculo-glandular reservoir the spleen, as Pallas shows (*l. c.* p. 43, tab. iii. fig. 11 *e*), is adherent to the left upper side of the paunch, a couple of inches from the cardiac orifice. It is flat and broad, some 6 by 4 inches in diameter.

2. *Genito-urinary Apparatus.*

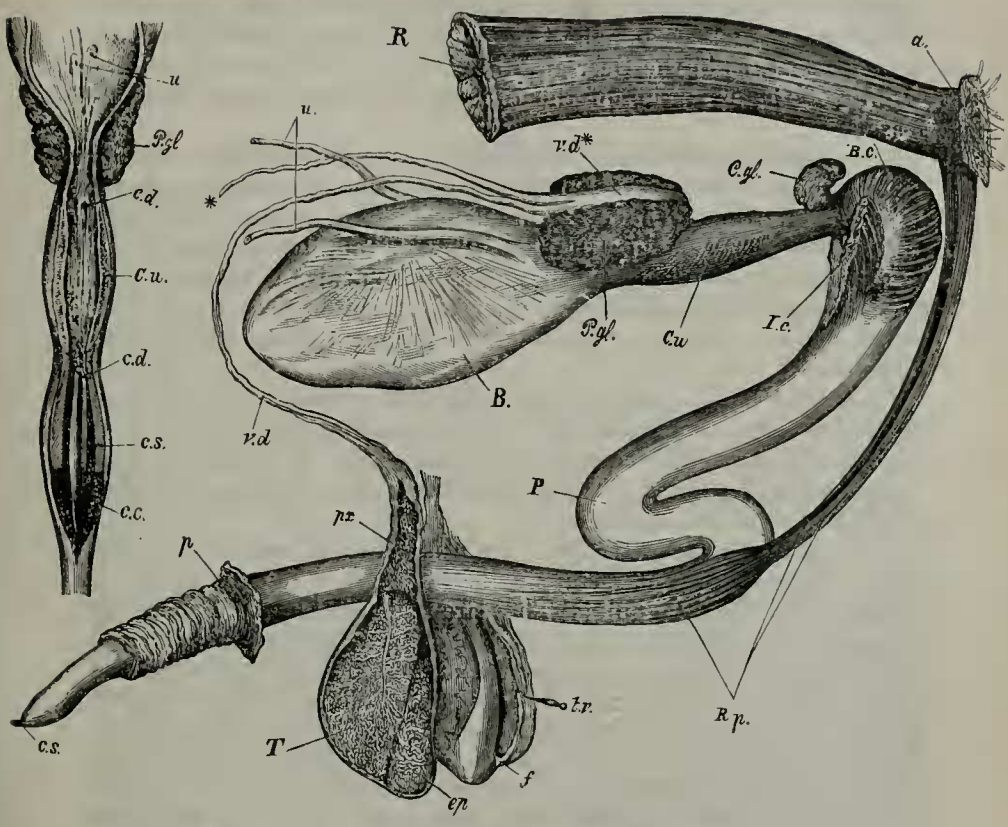
In the female the clitoris, the vagina, and the bicorned uterus, present no special features worthy of notice. The specimen examined, a young half-grown animal, had imperfectly developed mammary glands, upon which were four teats.

In the male Saiga, Pallas curtly adverts to the testes, penis, and its præputium; but he omits reference to the prostate and Cowper's glands, which are present. (*Vide* fig. 10.)

The scrotum is subglobular, and rather sessile than pendent. As Pallas observes, it is large—in the adult examined by me, equalling a small orange in size, and exteriorly covered by short white hairs. A considerable quantity of firm fat is imbedded within the scrotal sac, being deposited in greatest quantity at the root of the testes and around the cord. It forms indeed a septal division between the glands, and gives bulk to the scrotum.

The cremaster muscle is developed as a broad band descending as low as to opposite the globus major. The strongly fibrous tunica vaginalis (*t. v.* reflexa) is semitranslucent; its visceral portion (t. vag. propria) is still more delicate, and the lower uniting fold (*f*) situated about ·4 inch from the inferior end of the globus minor.

B. Fig. 10. A.



Reproductive Organs of the male Saiga.

A. Reduced sketch of a dissection of the parts, bearing somewhat their natural relations. *R.* Rectum. *a.* Anus. *T.* Left testis mesially bisected; the right is partially shown with its sac reflected. *ep.* Epididymis at globus minor. *t. v.* Tunica vaginalis dragged backwards; gyri of the spermatic vein are delineated upon the testicular surface. *f.* Fold between t. v. propria and t. v. reflexa. *px.* Plexus of spermatic vessels. *v. d*, *v. d**. Vas deferens; the right tube * has been severed. *B.* Bladder in its contracted condition. *u.* Ureters, cut short. *P. gl.* Prostate gland. *C. gl.* Cowper's gland. *P.* Penis, its sigmoid flexure. *p.* Præputium, retroverted. *c. s.* Terminal lip of the corpus spongiosum; the urethral orifice opens at its point. *R p.* Retractor muscles of penis. *B. c.* Bulbo-cavernosus. *I. c.* Ischio-cavernosus, cut from its bony attachment. *C. u.* Constrictor urethræ.

B. Segment of the urethra and bladder opened from above. *u.* Orifices of the ureters. *P. gl.* Prostate gland. *e. d.* Ejaculatory ducts. *C. u.* Constrictor urethræ muscle seen in section. *c. s.* Corpus spongiosum. *c. c.* Corpus cavernosum. *c. d.* Cowper's ducts.

Each testicle, with its globus minor, is egg- or, rather, spindle-shaped, and measures $1\frac{3}{4}$ inch long by 1 inch in broadest diameter. The body of the epididymis is broadish and band-like, the globus major and minor both being of considerable dimensions. The latter (*ep.* fig. 10) descends $\frac{1}{4}$ of an inch below the gland, and is back-

wardly protuberant. The white fibrous septum known as the corpus highmorianum, is linear, rather indistinct, and occupies the mesial axis. Owen † remarks of the Giraffe, where the septum is similarly situated, that, as in the Deer and the Antelope, it thus more readily permits of the expansion of the tubular structures in the rutting-season.

The sigmoid flexure of the penis (*P.*) occurs rather behind the middle or the organ. There are two strong band-shaped retractores penis (*R.p*) fixed in front of the bend; but delicate fibres are carried beyond, as a membranous-looking sheath. The præputium (*p*) is attached by a frænum 2 inches behind the point of the penis. The attenuated glans has an inferior oblique papillar extension of the corpus spongiosum (*c. s.*), which terminates in a minute orifice, the meatus urinarius.

Combined bulbo-cavernosus muscles (*B. c.*) produce a swelling almost as large as a chestnut. Each ischio-cavernosus (*I. c.*) is large and fleshy. The continuous thickish layer of the circular and oblique muscular fibres of the constrictor urethræ (*C. u.*), $2\frac{1}{2}$ inches long, form a powerful sphincter.

Two Cowper's glands (*C. gl.*), each as big as a bean, but pedicillate, are situated on the rectal side of the urethra, and immediately behind the root of the bulb. They are yellow-coloured, moderately firm, and separated from each other by fatty and fibrous tissues.

The vasa deferentia (*v. d**.) at the upper end of the neck of the bladder approximate, enlarge considerably, and form a thick, smooth, flattened, elongate mass, which fills the superior fissure between a pair of large glands. These glands, as I have noticed in the anatomy of the Prongbuck, may either represent prostate, vesiculæ seminales, or both. Considered as the homologue of a bifid prostate (*P. gl.*), they each are 1·2 inch long, ·7 inch deep, and together have a breadth of 0·8 in front, and 1·2 inches behind. In side view they are kidney-shaped, with an inferior mesial indentation. From above, including the enlargement of the vasa deferentia, they are somewhat quadrate, narrowing slightly in front. Their surface is smoothish, with the exception of the indentation above spoken of. A nipple-like process from the vasa deferentia pierces the compressor urethræ behind; and the combined secretion of the testes and prostate enters the urethra by a double orifice; ejaculatory ducts (*e.d.*) behind the middle of the membranous portion of the urethra.

The kidneys agree with the characters assigned them by Pallas, namely, subglobularly oval, a shallow hilus, and unsymmetrically placed in the loins. As he observes, the right one lies near the last rib, whereas the left one is much nearer the ilium. Both, in the male Saiga, were enveloped in a large mass of suety fat. They are smooth-surfaced, without lobulations. The cortical substance is unusually thick; and the single deepish sinus has some half dozen undefined pyramids and infundibula. In the male each kidney measured 2·8 inches long and 1·6 across.

Pallas notes that the suprarenal bodies are oblong or oval, green-

† Trans. Zool. Soc. vol. ii. p. 239.

ish-yellow, the right placed on the summit of the kidney, the left nearer the hilus. In one specimen only could I dissect them satisfactorily; and in this they were slightly separate from the kidneys.

3. *The Alimentary Canal and Accessory Glands.*

The œsophagus, 15 inches long in the female and 22½ in the male, has its cardiac orifice opening into the paunch, as obtains in most ruminants; though *Hyomoschus** and *Tragulus*† offer exceptions in its directly communicating with the reticulum. Pallas has figured the four-fold stomach of *Saiga tartarica*, and beside it has placed for comparison that of the *Antilope gutturosa*. His description of the former agrees in most particulars with what I have found, though, as might be predicted, his rigid measurements do not quite accord with my different-aged specimens.

I may reiterate that the paunch is capacious, and bifid at its greater curvature, the reticulum of moderate size, the psalterium is comparatively small, and the abomasus of fair dimensions.

It may further be noted that the cuticular papillary villi of the paunch are short and club-shaped. The cells of the reticulum are of moderate depth, with rudiments of stellate septa within. The folds of the psalterium correspond with Pallas's description, as do the plications of the abomasus.

The same authority mentions that in the abomasus there are often found woolly balls incrusted by a blackish tartar, as in the Sheep. But no such foreign substance was present in the digestive cavity of the Society's two specimens.

In our Proceedings for 1865, p. 262, Dr. Edwards Crisp makes the following statement:—"I supposed, until recently, that only the Camelidæ had water-cavities in the stomachs; but on dissecting an Antelope from Siberia, the Saiga (*Antilope saiga*), I was surprised to find two large water-bags in the rumen." Unfortunately my eye did not catch this paragraph until I had thrown away the said portion of the viscera of both animals. But I avow that I cut up in each Saiga the stomachs throughout their entire course, and aver that neither my assistant, who was present, nor myself detected such a structure. Pallas, whose opportunities were numerous, and who carefully describes the interior of each cavity of the stomach, does not allude to any such remarkable disposition of the parts.

Having great faith in Dr. Crisp as a careful and conscientious observer, I felt it but justice to communicate with him previously to reading this paper. He has been kind enough to reply to me, and as respects the above says, "I cannot find the paper of the dissection of the Antelope, nor can I lay hands on the dry preparation of what I supposed to be water-bags in the paunch; but I give you the size on the other side [alluding to a sketch enclosed]. These may be abnormal from a lesion, or some other cause; and if it is the

* Flower, P. Z. S. 1867, p. 957, & fig. 2.

† 'Sur la famille des Chevrotains,' Monograph by M. Alphonse Milne-Edwards: Paris, 1864.

Saiga, and you have found no such protuberances, such is probably the explanation. However, I am not quite sure as to the species of Antelope: I think Mr. Bartlett had some doubt about it."

In the well-conditioned male, as in Pallas's specimen, the mesentery was loaded with fat, which in great part covered the stomach and the convolutions of the gut.

As regards the extent of the intestinal tube, it is best expressed in the subjoined tabular view.

	Zool. Soc. specimens.				Pallas's ♂ spec.	
	ft. in.		ft. in.		ft. in.	
Small intestine.. in the ♀	33 2	.. in the ♂	37 7		39 10	
Cæcum..... „ „	0 12	.. „ „	0 $9\frac{1}{2}$		0 12·8	
Great intestine .. „ „	15 4	.. „ „	17 $11\frac{1}{2}$		16 5	

The lesser gut is throughout narrow. There is no ileo-colic sacculated gland as in the Giraffe; but the ileo-cæcal orifice has a broadish valvular fringe. The cæcum is simple, and neither it nor the colon is provided with longitudinal fibrous bands. Close upon two and a half feet of the cæcal appendage and the great intestine have a diameter of about a couple of inches; the remainder of the tube is of moderate calibre, with a very slight widening towards the rectum. The intestines describe gyrations and are spirally coiled.

My admeasurement of the intestines do not accurately coincide with those of Pallas; but this may be accounted for by variation in the animals' ages, or, mayhap, by reason of one being wild, the other confined and fed differently. Assuming that his observations and those of Cuvier * are correct, the intestinal tract is nearly equivalent to similar-sized Antelopes' and disagrees with that of the Sheep.

Entire intestine exceeds the body in length:—13·1 times, Stag; 13·6, *Saiga*; 14·9, *A. cervicapra*; 15·0, *A. gutturosa*; 28·1, Sheep. The small intestine is in excess of the great:— 1·4 times, Stag; 2·3, *A. gutturosa*; 2·6, *Saiga*; 2·7, *A. cervicapra*; 3·3, Sheep.

The Sheep-like liver is transversely broad, almost destitute of incisions; what answers therefore to a large left lobe is medianly imperfectly defined. The slight median notch and its round ligament are close to the fundus of the gall-bladder, thus cutting off from its due share of the anterior border the homologue of the lobus quadratus; the latter is moderately wide and triangular. The bayonet-figured caudate lobe is four inches long, and extends freely beyond the right border. A lobus Spigelii is but scantily developed. The relative diameters of the liver in the male Saiga were 10 inches transversely and 6 antero-posteriorly, in the younger female 8 and $4\frac{1}{2}$ inches respectively. As in the Bovidæ, the hepatic substance is soft, finely granular, and smooth-surfaced.

The short roundish gall-bladder is of moderate dimensions, its fossa small and shallow; the fundus, as in *Bison americanus*, reaches quite beyond the free border of the liver. The cystic duct and

* As given by Meckel, Anat. Comp. vol. viii. p. 446. Meckel's estimate does not correspond with the above data calculated from his table.

ductus communis choledochus are both narrow, and together over 3 inches long. The latter opens slit-wise into the duodenum, 7 inches (Pallas notes 10) distant from the pyloric orifice.

The pancreas and mesenteric glands present nothing worthy of notice.

4. *The Mouth and Organs of Deglutition.*

In the 'Spicilegia' quoted, the hairy upper lip, premaxillary pad, conical papillary fuscous buccal region, and livid tongue are briefly mentioned. I may add, however, a few remarks. There are a dozen forwardly convex linear and fringed transverse palatal elevations; behind these the surface is smooth and somewhat concave from the second molar backwards.

The dark coloration of the tongue is limited to its anterior half or that portion capable of being extended; the posterior moiety, on the contrary is very pale-coloured. In the male the gustatory organ was 6 inches long, and within a trifle of $1\frac{1}{2}$ inch broad at root. In general appearance it is uncommonly like that of a Sheep, much more so than to an Antilope's tongue. The root is thick and convex, the middle considerably narrower; and forwards from this it by degrees widens into a broad flat spatulate extremity. The tip is slightly notched in the median line; and from this a shallow furrow runs back for $1\frac{1}{2}$ inch. Below there is also a very shallow medial furrow $\frac{1}{2}$ inch in length. From the frænum linguæ the tongue is free for $1\frac{1}{2}$ inch. Between the tip and the anterior portion of the dorsum the surface is comparatively smooth, the filiform papillæ being very short, close, adpressed, and towards the posterior portion retroverted. Each lateral margin of the dark portion of the tongue, and an arch $\frac{1}{2}$ an inch deep underneath the tip, are beset with punctiform flat-topped papillæ fungiformes. The conical papillæ on the white convex dorsum are of moderate size, and, as in the Sheep, form a longitudinal ellipse. The papillæ circumvallatæ are few in number, of small size, and sparsely scattered in parallel longitudinal rows on the external surface of each side of the dorsum and root.

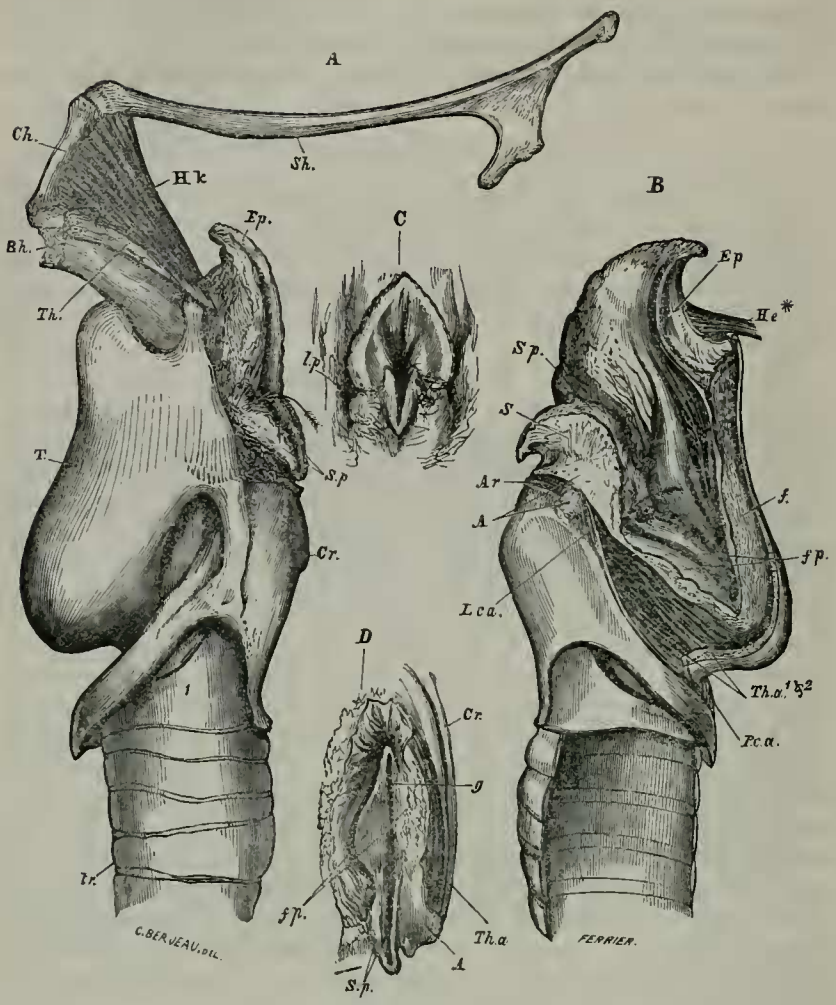
The Saiga being a delicate feeder, choosing, like the Goat, aromatic herbs, may account, physiologically, for vast numbers of gustatory papillæ found at the sides and under surface of the tip of the tongue.

The velum pendulum palati is a thick and deep fold, narrowing considerably the passage into the pharynx. The arch above is dense and muscular; but the free margin is much thinner and membranous. The two small follicular tonsillary glands are hidden within the pillars of the fauces; and open into the palatine arch by a narrow orifice in front of the epiglottis. The mucous membrane around the fauces is smooth.

The pharynx is a much wider cavity, and is abundantly supplied with submucous glands: its constrictor muscles have but moderate thickness.

Of the glands conveying their secretions by ducts into the mouth,

Fig. 11.



Larynx and Hyoid of the adult male.

A. Profile view of the outside. *T.* Thyroid ala, showing its inferior gibbosity. *Cr.* Cricoid cartilage. *tr.* Trachea,—1 marking its first, broader ring. *Ep.* Epiglottis. *S. p.* Projections over cartilages of Santorini; the arrow above indicates the upper laryngeal aperture. *Sh.* Stylohyal. *Ch.* Ceratohyal. *B h.* Basihyal. *Th.* Thyrohyal. *H k.* Hyo-keratic muscle.

B. Larynx dissected, the side of the thyroid cartilage and tracheal rings removed. *Ep.* Cartilage of epiglottis. *H e*.* Portion of the hyo-epiglottic muscle. *f.* Fat, and *f. p.* fatty projections on sides of glottis; the arrow points to aperture of the last. *Th. a.* 1 & 2. Lower and upper thyro-arytenoidean muscles. *P. c. a.* Part of the posterior cricoarytenoideus. *L. c. a.* Lateral crico-arytenoideus. *Ar.* Arytenoideus muscle, and *A.* artytenoid cartilage. *S.* Cartilage of Santorini. *S p.* Projection of Santorinian cartilage and fatty tissue.

C. Pharyngeal view, epiglottis and superior aperture of larynx. *l.p.* Exterior laryngeal pouch.

D. Partial dissection, displaying from above the false vocal cords and chink. *Cr.* Segment of the cricoid. *A.* Upper view of arytenoid cartilage. *S.p.* Projections of cartilage of Santorini on one side, and fatty covering on opposite moiety. *f.p.* Anterior fatty prominences bounding (*g*) fissure of the glottis; the tissue on the left side has been cut off.

the parotid (fig. 8, *P. gl.*) needs be mentioned, as of very large size, wide, flat, and coarse in texture, as, indeed, is the case throughout the larger Bovidæ. Stenon's duct (*St.d.*) is capacious and long, curves round the mandibular angle in company with the facial vein (*F.v.*), dips into the cheek-tissues, and finally opens by a papillary orifice close behind the angle of the mouth. In the Common Goat Stenon's duct opens much further back in the mouth. There is a small flat glandular mass (fig. 8, *Gl. s*), spread thinly upon the surface of the buccinator muscle, and entirely separate from the parotid, though in connexion with the Stenon's duct. This buccal gland may be the homologue of the so-called *socia parotidis* in Man, here thrown considerably forward, and quite isolated from the parotid itself. The submaxillary gland appears closely commingled with the parotid. The sublingual gland is well developed, lies in the usual situation alongside the tongue, and is very elongate, corresponding with the shape of the latter organ.

The large dimensions of each and all of these salivary apparatus is not peculiar to the Saiga; for, as is well known, in the whole of the ruminants it attains considerable volume.

5. *Vocal and Respiratory Tract.*

When the pharyngeal wall is cut through and reflected, the upper laryngeal parts present the following aspect (*vide* C, fig. 11):—The aryteno-epiglottic folds are large, and lie outwards, giving breadth to the deeply excavated laryngeal opening. The glottis is an elongate arrow-headed fissure, wide in front and narrowed behind. The posterior floor or basal end of epiglottis has two parallel longitudinal narrow ridges, which descend towards the rimal aperture. Outside the aryteno-epiglottic folds and between them and the thyroid cartilaginous alæ are deep and wide cavities (exterior laryngeal pouch, *l. p*), the posterior ends of which curve inwards. Bounding the narrowed hinder end of the glottis are two long narrow membrano-fatty projections, which unite behind and thus form a compressed V-figure; these (lettered *s.p*, in cuts A, B, D, fig. 11) are eminences produced by thickened tissues surmounting the upper border of the cartilaginous plates of Santorini, or, possibly, combined with these cuneiform cartilages. With its side folds, the epiglottis looks full, is somewhat triangular in outline, and less than an inch in its diameters.

A deeper dissection of the upper laryngeal cavity, as in the side view B and upper view D, shows that this is capacious, and that the walls, both laterally and in front, are padded with fatty matter (*f*). This, with its mucous lining, forms numerous thick longitudinal folds; and quite in front is a sulcus, which, descending, leads into a small pouched cavity within the depending globosity of the thyroid cartilage. This recess, hidden by the folds spoken of, is slightly locular or gland-pitted within. The chink of the glottis (*g*), commencing immediately behind this pouch, has an antero-posterior diameter of 2 inches. Its anterior half is bounded by two consider-

able-sized ploughshare-shaped fatty projections (*f. p*) meeting in front. External to each fatty mass there is a deep furrow which tends forwards to the anterior thyroid saculus. The posterior half of the laryngeal aperture is walled by the Santorian cartilages (*S*) and adipose coverings (*s. p*), the aryteniod cartilages flanking these.

There are no lateral sinuses or ventricles other than those described.

The adjoining lips of the rima glottidis forming the true vocal cords are continued down from the fatty eminences for the depth of an inch, and are set at an oblique angle, parallel with, but above the anterior ring of the cricoid. They are smooth-surfaced, and, in the relaxed condition of the parts, approximate, leaving but a narrow fissure. The aperture behind them, at the arytenoid and Santorini cartilages, is a trifle wider; and from these the inferior cavity of the larynx descends as a funnel between the vocal cords, the posterior cricoid shield, and the expanded hinder arch of the uppermost tracheal ring, to the large tracheal passage itself. Thus, as in *Hyomoschus**, there is a partially cylindro-tubular passage behind, more or less divided by the thrust-forward vocal cords from the anterior or upper thyroid chamber.

Cleared of superincumbent tissues, the thyroid cartilage (*T*) exhibits two thin but broad and long lamellar alæ, and, besides, a median and very remarkable enlarged gibbosity. This salient inflation inclines towards, but does not reach, the anterior cricoid arch. The thyro- and crico-hyoid muscles do not cover it, the inner border of the former filling a shallow valley on either side. There is a shallow median notch at the anterior border of the cartilage.

Each anterior cornu is about $\frac{1}{2}$ inch long, moderately narrow, and composed of thin translucent fibro-cartilage. The posterior cornua are much stouter and twice the length of the preceding. The upper and lower cornual appendages are situated in a line with each other, though widely apart, and directed contrariwise. At their inner roots the thyroid border is widely emarginate, the lower deeply so, through which passes the cricoid ring and crico-thyroid muscle. The entire surface of the thyroid cartilage is smooth and with no defined oblique line. In extreme length it is $2\frac{1}{2}$ inches, and its greatest diameter 1·8 inch.

The cricoid (*C*) is much the stronger cartilage. Its posterior surface is carinate, the broad upper border being transversly arched and free from incision; the lower border is thin and terminates in a spatular cartilage. The anterior segment of the cricoid ring descends obliquely from opposite the postthyroid cornu. At first broadish, and then gradually narrowing, it meets its fellow of the opposite side in the form of an inverted gothic arch, which, expanding, overlaps the first and partly the second tracheal rings. The postero-cricoid shield is 2·1 inches long, and $1\frac{1}{2}$ inch broad, and each moiety of the anterior ring is a couple of inches in length.

Each arytenoid cartilage (*A*) is about 1 inch long, and, attached by a joint to the upper and outer angle of the cricoid shield, passes

* Flower. P. Z. S. 1867, p. 957.

therefrom in an oblique line cutting the said point and the thyroid gibbosity. It has an irregular elongate triangular figure, $\frac{1}{2}$ inch broad behind and narrow in front. Its borders and surfaces are more or less concave; and the cartilage altogether is stout, thick, and from 0·3 inch deep behind lessens considerably forwards. At the external cricoid joint there is a considerable-sized nodosity; and the inner superior margin is crescentically ridged and overtopped by the cartilage of Santorini.

The latter (*S*) is a thin falcate lamella of soft yellow fibro-cartilage, some 0·8 inch long, and above 0·3 inch in extreme depth. It forms a crest, as said, to the arytenoid, and is itself covered by a fatty layer, producing those posterior elevations of the postlaryngeal aperture (*s. p*) already dilated on. It may be that these include the cartilages of Wrisberg, which otherwise are wanting.

The cartilage of the epiglottis has a consistence like the last, is of obcordate shape when cleaned of investing membrane, and has a retroverted broader tip than in the Prongbuck.

As regards the structure of the Saiga's larynx, it may be regarded as an intermediate type between the Sheep's and that of some Antelopes and Deer. In *Ovis* we have a rudimentary condition or tendency of the thyroid cartilage to inferior enlargement. This becomes more marked in such forms as the *Gazella dorcas*, *G. rufifrons*, and *Tarandus rangifer*, as Meckel* has noted. In *Hyomoschus aquaticus* this protuberance is increased in dimensions, as Flower† figures, but is not, as he supposes, peculiar to this Ruminant; for, as long ago demonstrated by Pallas, the *Antilope gutturosa*‡ is notorious and specifically named on account of its great thyroid development, which is said, indeed, to produce quite a gular swelling. As figured, this thyroid inflation is several inches in diameter. The single thyroid sacculus contained within, doubtless coexists in these latter forms, as in *Saiga*, thus differing from several of the Pachyderms' and other types, where there are a pair of lateral sacculi. In the Horse, however, there is a similar recess at the base of the epiglottis.

Concerning the voice of the Saiga, if this be studied not purely physiologically, but as a sign indicating affiliation of stock, it is of some interest. The tone and manner of utterance is remarkably like that of a Sheep, to wit, a single full bleat or bay, the shrill treble note of Goats and most Antelopes being markedly varied from that of the above genera. The Deer generally have a more grunting tone, though extensively modified in different genera, as, indeed, also obtains in the Antelope section.

Of the muscles connected with the larynx and its bony arch, the sterno-hyoid and sterno-thyroid, long and fleshy, are united opposite the posterior end of the thyroid gland on the fourth cartilaginous ring of the trachea: here they separate; the former continues in the middle line to the os hyoides, whilst the narrower sterno-thyroid diverges slightly outwards, and is inserted by a short broad tendon into the outer posterior margin of the thyroid cartilage. The crico-

* Anat. Comp. vol. x. p. 604.
† *Loc. cit.* p. 955.
‡ Spic. Zool. tab. iii. fig. 16.

hyoid has the usual attachments, but is very broad, and obliquely directed inwards and downwards or backwards.

The thyro-hyoid is a remarkably long, broad, and thin sheet of muscular fibres: origin, sides of thyroid alæ, exterior to the salient protuberance; insertion, the whole of the basihyal and the thyro-hyal cartilaginous rods. A broad portion of the median constrictor passes on to the thyroid ala beneath it. The stylo-hyoid, fleshy and strong, pierced by the median tendon of the digastric muscle, is inserted broadly into the basihyal. I may note also the presence of a large triangular fleshy muscle, the so-called hyo-keratic of some authors (*Hk*).

The crico-thyroid is notable by the obliquity of its fleshy fibres. These meet in the median line, are attached to the upper border of the cricoid in front, but laterally cover it; ascending backwards, the fibres are inserted into the cricoid margin of the thyroid ala. The posterior crico-arytenoidei (*P. c. a*) are large but thin, and fit the shallow concavity of the cricoid shield. Owing to the oblique downward position assumed by the anterior cricoid ring, only short narrow wedged-shaped fasciculi of muscle represent the lateral crico-arytenoidei (*L. c. a*). Each arytenoideus muscle (*Ar*) is fairly developed, and, as usual, fills the post-concavity of the arytenoid cartilage. The thyro-arytenoidei (*Th. a* & *Th. a.* 1 & 2) are great soft muscular bands imbedded amongst and partially interwoven with fatty tissue. They take origin within the cavity of the thyroid prominence, and, proceeding backwards and upwards, partly covered by the cricoid and thyroid alæ, are inserted into the root and outer margin of the arytenoid cartilage.

The bones composing the complex hyoid arch are each relatively long; but there does not seem to be present such a very elongate fibro-cartilaginous styloid cord as is figured by Pallas in the male *Antilope gutturosa*. In the Saiga, as in it and the Sheep, the basi- (*B h*) and thyro-hyals (*T h*) thoroughly interblend together and constitute a high arch, from the summit of which three short blunt processes spring. The middle one, the strongest and most projecting, is the rostrum of the basihyal; the outer ones, or wing expansions of the bone, give lateral breadth rather than branch forwards. From these the styloform thyro-hyals retrograde. The basihyal is just under 1 inch broad, and each thyro-hyal $1\frac{1}{2}$ inch long. The latter were cartilaginous, the former semiossified in the Society's male specimen. The cerato-hyals (*C h*) have a free articular surface at each end. The epihyals nearly correspond, though, unfortunately, not defined or lettered in A, fig. 11. They each are less than an inch long, their ends swollen and body laterally compressed. The stylo-hyal (*S h*) is fully 3 inches in length, the body slender, but the cranial end expanded into a flat somewhat rhomboidal figure. The upper spur terminates in a small tympanic bulb; the lower spur broadly descends, and, with concave antero-posterior margins, bends forwards in a spine.

Comparing the hyoid of *Saiga* with the Sheep's, it is altogether more delicate, and each bone longer. The spurs of the cranial end

of the stylo-hyal are much shorter and stouter in the Sheep. The Antelopes conform more with *Saiga* in the contour and slenderness of their hyoidean elements, and more so than do the generality of the Deer.

Fig. 12.

Head of the male Saiga in its winter coat. From a drawing made under the author's supervision while the animal was living in the Gardens*.

The trachea, as noted by Pallas, is large. The cartilaginous rings, forty-nine in number, are wide, and do not meet behind, the fibrous

* I am indebted to Mr. Glass, the editor of 'Land and Water,' for the use of this woodblock. Remarks on the animal, by Mr. Blyth, will be found in that publication for 14th December, 1867.

interval being broad. Several of the uppermost rings interdigitate. In front the first one corresponds in width to the succeeding rings, but laterally and behind it expands in a broad triangular form, the anterior or upper margin of which fits into the lower arched border of the cricoid cartilage.

The lungs agree with Pallas's description, the left trilobuled, the right tripartite above, and a large lobe below, with a partial lobule at its upper and inner corner.

IV. Exterior Characteristics.

1. *Form and Integument.*

Without hesitancy I offer testimony to the unusually lucid and succinct manner in which Pallas sets forth his descriptive remarks of the external characters of the *Antilope saiga*; and his illustration of the animal is equally happy. Wolf's coloured lithograph in our 'Proceedings,' 1867, pl. xvii., depicts the species in a different seasonal dress; and consequently the neck has a thicker aspect than in the former author's figure.

It is in the hornless female that one quickly traces Sheep-resemblances, the addition of the erect annulated horns in the male masking or altering the ovine expression. Seen from above, the hornless head is long, and, indeed, rather Pig-like, the ears standing well out, the jaws tapering but slightly towards the broad truncated nostrils. The capacious, patulous, oval nasal apertures are a most remarkable feature in the front view when the head is raised. In the adult male (fig. 12) the prolongation of the nasal trunk is greatest, and there is a thick tuft of long hair springing from beneath the eye and overhanging the cheek, besides a fringe of long hair at the margins of the ear, which heightens the uncouth aspect of the animal.

As regards bodily dimensions, these have been amply given in the table (p. 37) of the 'Spicilegia.' From my measurements of the dead bodies it appeared the adult male stood higher at the withers than at the loins, the reverse being the case in the half-grown female.

A circumstance is mentioned by Pallas which merits attention as affording an inkling of affinity. I allude to the fact that the horns of the Saiga are subject to inconstant abnormalities as regards number. He says (*l. c. p.* 35), "Certis testimoniis consentientium venatorum, quos veraces alias expertus sum, plurium teneo, reperiri interdum succenturiato ad alterum latus minori cornu *tricornes mares*; reperiri æque raro *unicornes*, cornu majori, monstroso varieque torto in media fronte instructos."

Among the Deer it is no uncommon thing to find irregularities or abnormalities in the growth of the horns—for instance, in the production of extra snags or non-development of the normal ones. No Deer, however, to my knowledge, possesses more than two branched antlers or cervine horns proper; nor do I know of any case where

excess of this number has occurred as a malformation. The fossil forms, *Sivatherium giganteum* and others, it is true, may be cited as an exception, as it unquestionably bore two postfrontal palmated antlers, likewise two infrafrontal or supraorbital horns with cores.

Again, among the Antelopes the genus *Tetracerus* is the only living representative normally carrying four well-pronounced and separate hollow horns. But neither in *Tetracerus* nor *Sivatherium* do the two supernumerary horns occupy the position assigned by Pallas to the extra ones of *Saiga*. With the limitation above mentioned the Antilopine, like the Cervine, group present no examples deviating from the common rule of two horns.

It is, I believe, alone the Ovine family of the *Bovidæ* which are subject to great variation as respects the number of horns; and hence among sheep one, two, or as many as six postfrontal horns are not unfrequently met with. Nay, more, there are well-defined breeds of four-horned Sheep wherein two horns are erect and not unlike those of *Saiga*, mayhap less annulated; whilst the second pair are broader, flat, and down and inwardly curved. In this respect, therefore, and in the semitransparency of the corneous texture, *Saiga tartarica* gives indications of family relationship rather with Sheep than with Deer, Antelopes, Goats, or Oxen.

Concerning the structure of the core supporting the horns, this, on being cut into sections, longitudinal, transverse, and tangential, was found to consist of osseous substance neither very cellular nor very solid*. Interiorly throughout almost the entire length of the core were minute parallel and partially interweaving tubuli or pores. These were of greatest diameter towards the base; but it was not ascertained whether they communicated with the frontal sinuses, though from appearances I presume they did so. The external and more solid part of the core is finely grooved.

Between the bony horn-core of Antelopes, Sheep, and Goats, that of *Saiga* may be placed as intermediate, though as regards textural fineness it agrees most with the first mentioned. Colonel Smith's opinion, endorsed by Dr. Gray and opposed to that of M. Geoffroy St.-Hilaire, Cuvier, Latreille, and others, is that *Antilope*, *Capra*, and *Ovis* assimilate as regards core horn-structure, but differ from the *Bovidæ* in the cancellated tissue being of a closer consistence.

The nature of the hairy coat and the manner in which it is annually shed are pertinent as regards affinities.

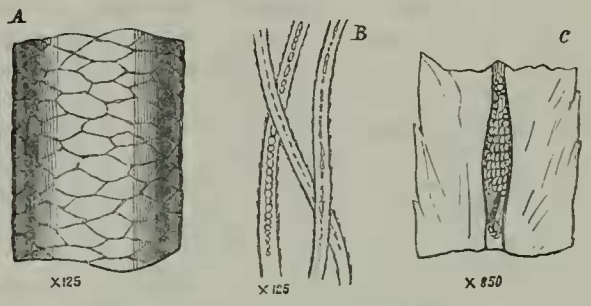
First, it is well known the animal assumes a summer and a winter fleece; that is to say, a periodical shedding takes place. Now this changing of the Saiga's coat occurs differently from what is witnessed in Deer and Antelopes, where replacement proceeds hair by hair, so that no sudden alteration is observed. In Sheep, as is notori-

* The animals examined by me having been disposed of for skeletons, I had no permission to cut into their horns or skull; but through the kindness of Mr. Bartlett an odd horn in his possession was put at my disposal, and sliced as above stated.

ously the case, the fleece annually is pushed off *en masse*, or in great patches, by a more or less uniform fresh growth beneath, and at such times the alteration of appearance is very marked. The Ovine fashion is that which *S. tartarica* follows.

Secondly, the hair of the Saiga has the inherent quality of felting. This property, opposed to its comparative absence in Antilopidæ and Cervidæ, is conspicuously prominent in the whole of the Ovidæ. The tenuous underwool (fig. 13, B, C) which works out in flat masses, weaving and binding together the coarser fibres (the process of felt), is not so fine and delicate as in some ruminants, *e. g.* the Prongbuck; but its cohesive wool-properties are undoubted.

Fig. 13.



Microscopical structure of the Hair and Wool of the Saiga.

A. Portion of a hair-shaft, showing the large cellular medulla and thin cortical layer.
B. Magnified view of wool; and
C. Portion of the same under a higher power, displaying the central cavity and pith-cells.

Thirdly, very critical evidence of the consanguinity of *Saiga* to *Ovis* is shown in the microscopic constitution of the hair. Indeed in this respect it would appear to have affinities or leanings more towards the Cervine than the Antelope type. The finer filaments, or wool *sui generis*, need no further mention; but the thicker brittle fibres, or true hair, have relatively and absolutely a very thin cortex, whilst the medulla is composed of unusually large cells, somewhat hexagonal in contour, though with evident tendency to a transverse wide ellipse (fig. 13 A). These characters cling to the hair of all Sheep, and gradate towards the rather smaller-sized, many-sided, cellular structure of the Deer's hair. In the Antelope group, *A. cervicapra*, for example, the cortex is much thicker, the cells extremely small and so compressed that under low powers they seem as if but transverse striæ. The hair of the mountain-loving Chamois, however, is well nigh identical with that of *Saiga*. The Goats have hair which may be said to stand midway between the Antelope's and Deer's, inasmuch as the cells are of diminished size, oval, but considerably compressed in the long direction of the hair; the cortical layer, moreover, is dense.

Amongst habits peculiar to the Saiga, and which in some senses

appertain to the external characters of the animal, are its modes of progression, defence, and attack. As Mr. A. D. Bartlett and myself have noted, its walk is sedate and steady; but when frightened or pursued, it alters its step and springs with a series of bounds in a vaulting manner. This movement is very different from that of Deer or Antelopes (except in few instances), which trot or canter, two feet touching the ground at the same time, according to the pace adopted; whereas, like mountain-Sheep or Goats, the Saiga jumps elastically, all fours leaving the ground at once. The ischiatic nerves of the last are of immense calibre; but whether this might be adduced as a physiological evidence of the above habit I will not pretend to say.

Pallas appears to think that the ample larynx and respiratory organs sufficiently account for their great swiftness, and quotes Cook * in proof of their speed. The latter says they are the finest runners he ever beheld, at first outstripping a greyhound, though not holding out so long: their feet seem scarcely to touch the ground.

When Deer fight they run against each other forcibly or tilt their horns in a scooping manner. Antelopes use their horns, or charge with a jerking movement of the head. Goats rear and strike downwards. Cattle toss, gore, or bruise with their head. The clashing butt of Sheep is notorious, as any one is cognizant of when two rams fight. They rush backwards, and by a run gain impetus, and smash head onwards with fearful violence. I have myself witnessed more than once an animal killed outright by the shock. The Saiga, as far as the above habits are concerned, is a true Sheep, and not at all an Antelope.

2. *Cutaneous Glands.*

It is well known that the Ruminantia possess cutaneous secretory structures in various parts of their body. The most obvious of these are the suborbital glands. Another series, either found on two or on all four feet, are the interdigital sacs; whilst yet others, of more inconstant presence and significance, are found in the dermal substance of the groin, on the tarsal segment of the limbs, or on the back of the head and rump. This subject has received attention from Jacob †, Owen ‡, Colonel Hamilton Smith §, Hodgson ‖, and others; but the most critical digest is to be found in the masterly Essay of the Society's late and learned Secretary Mr. William Ogilby ¶.

In both the male and female specimens of *Saiga tartarica* examined by me I have found, with a partial variation of the con-

* Voyages and Travels through the Russian Empire (Edinb. 1770), p. 317.
† Rep. Brit. Assoc. 1834.
‡ P. Z. S. 1836, p. 37.
§ Griffiths's Transl. 'Règne Animal.'
‖ Journ. Asiat. Soc. Bengal, 1832, and P. Z. S. 1834, p. 80.
¶ "Monograph of the hollow-horned Ruminants," Trans. Zool. Soc. vol. iii. p. 33.

dition of the inguinal integument, the same subcutaneous glandular apparatus extant. A single description, therefore, will suffice for both. Pallas, it may be remarked, has partially indicated what I shall describe more in detail.

1. There are two small suborbital glandular sacs, the so-called crumen, lachrymal sinus, or tearpit of some authors, which yield a thick whitish or pale-yellow exudation. These are situated in front of the orbit, and slightly below the median transverse line of the eye. In the younger female the small external openings of these were placed $\frac{3}{4}$ of an inch, and in the male $1\frac{1}{2}$ inch, in advance of the orbital ring; but the sinuses or sacs themselves lay in the broadish and moderately excavated infraorbital fossæ.

2. Each foot, as in the Sheep, possesses an interdigital sac about $1\frac{1}{2}$ inch in depth, and opening by a narrow constricted aperture at its front and upper part. The orifice is hidden by very short closely placed yellowish hairs, whilst below these the sac is superficially covered by a tuft of much stronger and longer hairs. The secretion derived from these interdigital bags is yellow and of a hardish ceruminous character.

3. On the anterior aspect, but slightly to the inner side, of each fore knee is a small dermal gland, or a thickening of the cutaneous tissues, covered by a brownish patch of firm hairs.

4. In the inguinal regions of both sexes bare oblong or lozenge-shaped spaces exist; each of these is 5 inches or more in extreme long diameter. Upon their inner edges in the female the imperfectly developed udders and four teats are situated. There are no pouches or sacculations in the anterior part of these bare spaces, as obtains in *Cephalophus dorsalis* and some other forms, the skin in the Saiga being dry and nearly void of cuticular secretion; but at the postinguinal extremities in both sexes of the latter animal there are glandular pores. In the male there is a very marked crescentic skin-fold $\frac{3}{4}$ inch long and about $\frac{1}{4}$ inch deep; and this interiorly contains abundance of minute pore-like glands and a free secretion. The odour of the secretion is faint and ceruminous.

The same portion of the postinguinal space in the young female differed from the male in there being no tegumentary sac or induplication of the tissues; but a smooth-surfaced secretory apparatus was present, and from this a moist waxy substance exuded.

From what has been detailed above it follows that the true aggregated cutaneous glands of the Saiga Antelope altogether are ten in number.

Upon my carefully dissecting and reflecting the skin of the groin beneath these postinguinal pouches or folds, I was surprised to find that they each possessed a retractor-like muscle. This was a small flat narrow fleshy band inserted on the middle of the duplicature of the skin; from this it ran outwards across the posterior end of the abdominal muscles, and appeared to arise beyond the general opening on the surface of the iliacus and between it and the fibrous expansion of the external oblique muscle.

The use of this well-defined muscular slip is to draw inwards and

sacculate the glandular portion of the skin of the groin. I am not at present clear regarding its homology; but the better to call attention to the existence of this muscle, I propose temporarily to denominate it the *invaginator sacculi*.

V. Systematic Position of the Saiga tartarica.

When what is regarded among zoologists as an exceptional form, either in a family or genus, is put to the crucial test of anatomical detail, it is oftentimes hard to assign the creature a definite place, even when in possession of the more complete data. Such an animal is the Saiga!

The difficulty in this as in similar cases springs mainly from two causes. One is the value to be attached to any single character or set of characters; for upon this point the most conflicting views are entertained equally among the younger school of naturalists and among the older authorities.

The other cause arises out of the circumstance that in most species such as that under consideration we have what the indefatigable embryologist Parker very deftly expresses in birds as "a generalized form," moulded akin to no special group, but, as it were, a combined patchwork of varied structural organization.

The characters assigned by Pallas (*l. c.* p. 14) in his analysis of the genus *Antilope* * are, "*Ant. saiga* (cornibus distantibus, lyratis, pallido diaphanis, naso cartilagineo ventricoso)."

Setting aside older and subsequent authors, I may mention that Dr. Gray †, with the addition to the above definition of its crumen (suborbital gland), distinct and soft fur, generically subdivided *Saiga tartarica* among the "Antelopes of the Fields" in his synopsis of the Bovidae. Mr. Turner ‡, in grouping the hollow-horned Ruminants from a study of their crania, unfortunately did not see a skull of *Saiga*. Provisionally, from the shape of the horns, that able anatomist placed it under *Gazella*, though animadverting upon Gray's generic separation because of their pale colour. The reply of the latter (Cat. B. M. 1852, p. 51) sufficiently answers the objection. This translucency of the horns, moreover, has even greater significance than their lyrate, annulated character, and, together with their occasional multiple number, decidedly evinces affinities to the Ovine type. Doubtless in size, shape, and position they conform to the Gazelles. So far, therefore, as outward aspect is concerned, they belong to the Antelope section, but not necessarily so; for in the four-horned breeds of Sheep, and even in some of the two-horned varieties (*e.g.* the Wallachian Ram), these organs to a certain extent assume the said peculiarities.

When the skeleton comes to be considered, the skull, as rightly interpreted by Turner in other Bovidae, affords distinctive marks of its family relationships. Whilst exhibiting structural formation pe-

* See Ogilby's critical remarks thereon, Trans. Zool. Soc. vol. iii. p. 38.
† Ann. & Mag. Nat. Hist. (1847), vol. xviii. p. 227.
‡ P. Z. S. 1850, p. 168.

culiarly its own, it, at the same time, as the comparison already entered into has shown, deviates in several characteristics from the genus *Gazella*, as indeed it does from all modern *Antilopidæ*. Still though endowed with a basis of Ovine construction, it sheers off from this group and engrafts itself with the Antelopes. Over and above it reverts to those strange ancient Deer-like forms of the Tertiary epoch, though isolated from the recent Cerfs, not excepting the abnormal-nosed Elk.

The vertebral column is neither strictly that of an Antelope or Sheep, but a mixture of both, with a specialized atloid transverse process. The pelvic arch in the male is nearest allied to that of the Ram, the scapula to the Antelope's. In relative lengths of the limb-bones the fore extremities range with *Ovis*, the hind legs with *Cervus*; but in fineness of symmetry they have more a Gazelle aspect.

Skeletally there are shades and grades of various groups of Bovidæ intermixed, truly one of Parker's "generalized forms," so interblending by structural ties of families otherwise removed, that old taxonomic lines of demarcation are resistlessly swept away.

All the habits of *Saiga* are consistent with those of a Feral *Ovis*. As to the fleece, taken in all its bearings, it does not belong to the Gazelle group nor Antelope proper, but essentially is a slightly modified species of Sheep's wool. I should say of the interdigital sacs, crumen, and knee-patches, that they, in this case, hardly afford satisfactory grounds to base affinity upon. The remarkable internal nasal or maxillary sinus, besides the nasal enlargement, nevertheless leads on apace to Pachyderms, where, as in the Tapir, such maxillary sacs, elongate cartilages, and modified proboscides obtain. The fact that there is abundant fatty deposition, in the fleshy structures outside the body as well as viscerally, and in the scrotum, is in favour of Ovine affinities; in most Antelopes, and universally among Goats, fat is developed meagrely on the body and omentum, being chiefly found *en masse* surrounding the kidneys.

The relatively elongate heart is that of an Antelope or Deer; and the intestinal length conforms with these rather than Sheep.

The final result of all the evidence which can be gathered from the anatomy of the singular *Saiga tartarica* leaves still doubts regarding the creature's place in any one of the *present groups* of the *Bovidæ*. It cannot be said to be purely an Antelope, though in many particulars it announces alliance with the genus *Gazella*, among which, however, I must reject its admission. To the Sheep tribe it is even more related in a variety of characters; yet must it be excluded from either of Gray's Ovine genera (Cat. B. M. p. 160) *Ovis*, *Caprovis*, *Pseudovis*, and *Ammotragus*. Betwixt the above subfamilies or subtribes the Saiga appears to hover, masking under an Antilopine aspect much that belongs to Ovine race. Again relations of no mean kind, whether in a physiological or anatomical point of view, link it with the ancient quadricorn *Siva* and *Titanotheres*.

The non-position, so to speak, of the Saiga among present groups having been established, the difficult task of assigning a location and defining systematic characters for it remains; and here the proposi-

tion as to the relative value of these is encountered. If horns are the test, the place assigned it by Gray and Turner cannot be objected to. If tried by Ogilby's standard of the form of the upper lip, and distribution of cutaneous glands, or Sundevall's proposed arrangement by hoof-structure, it may claim kindred with several widely different tribes.

If teeth rule, or visceral structure prevail, it is of alien stock. If the skeleton, and specially the skull, decide its position, there is still something equivocal in its kinship.

Thus, what I have said of the Prongbuck is applicable to the Saiga: both constitute forms of intermediate position, and defy the mandate of systematists who rigidly circumscribe the boundaries of groups. They tell in the strongest terms how interblended are the Ruminant tribes and subtribes. Every fresh fossil remnant, moreover, proves the truth of this dictum, and makes even the definition of genera unstable, generic limitation, in the present state of science, being a manifold convenience.

The Saiga, to all intents and purposes, may be regarded as an Antilopine Sheep, not absolutely a Sheep, but an offshoot derivative of the genus *Gazella* rather than of Turner's Ovine Antelopes, *Nemorhædus*.

With this shifting of tribal alliance, Dr. Gray's generic rank to it would remain, with the addition of such anatomical characters as I have enunciated.

Genus Saiga, Gray.

Horns roundish, lyrate, annulated, translucent. Nose very high and produced, walls soft, cavities capacious, and orifices patulous. An internal maxillary sinus or pouch. Crumen, inguinal, and interdigital sacs present. Fleece ovine but short. Molars without supplemental lobes; the median incisors only moderately expanded. Nasals and præmaxillæ very short and far apart; a wide vacuity above. Maxillary produced as a shallow rostrum. Lachrymal higher than broad; no naso-lachrymal fissure; a shallow impressed suborbital fossa; masseteric ridge rising before the orbit; basi-occipital flat, as wide as long, or slightly more expanded in front; anterior basilar tubercles well developed, the posterior ones less so, but not small; auditory bullæ moderate, partially inflated; a mastoidal or supraparamastoidal concavity; spheno-pterygoids high, approaching the vertical. Horizontal palate-plates reaching far back; posterior nares wide and deep. Limb-bones of moderate length, with Ovine proportions and Antilopine symmetry. Male thyroid cartilage somewhat gibbous, but no internal laryngeal pouch; thyro-hyals long. Intestines Antilopine in their moderate length and proportions. A gall-bladder present. A well-developed prostate and Cowper's glands; penis terminating by a short whip-like extension of the corpus cavernosum.